



FRIDAY, NOVEMBER 29, 1878.

Contributions.

Splices for the Lower Chords of Wooden Bridges.

TO THE EDITOR OF THE RAILROAD GAZETTE:

The article on the above subject in your issue of Oct. 18 last has led me to send you the inclosed sketches of tension joints for timber work, the most of which have been long used, and proved good. Notwithstanding the wide adoption of iron for bridges, it is the fact, at any rate in some parts of the country, that at least half of the railroad bridges and more than half of the highway bridges are still made of wood. The point in a wooden bridge requiring the utmost care, both in design and execution, is of course the tension splice for the lower chords. This splice is very often, if not always, the weak point which limits the strength of the bridge. It is not an uncommon thing to see a lower chord

far apart, the shoulders and the splice may be of wrought-iron and made in a single piece.

Fig. VI. has long been in use, and has been found to answer very well, though the percentage of wood retained is not so high as in some others. When the packing blocks are placed abreast of the casting, which is frequently done, the percentage of wood retained falls as low as 50.

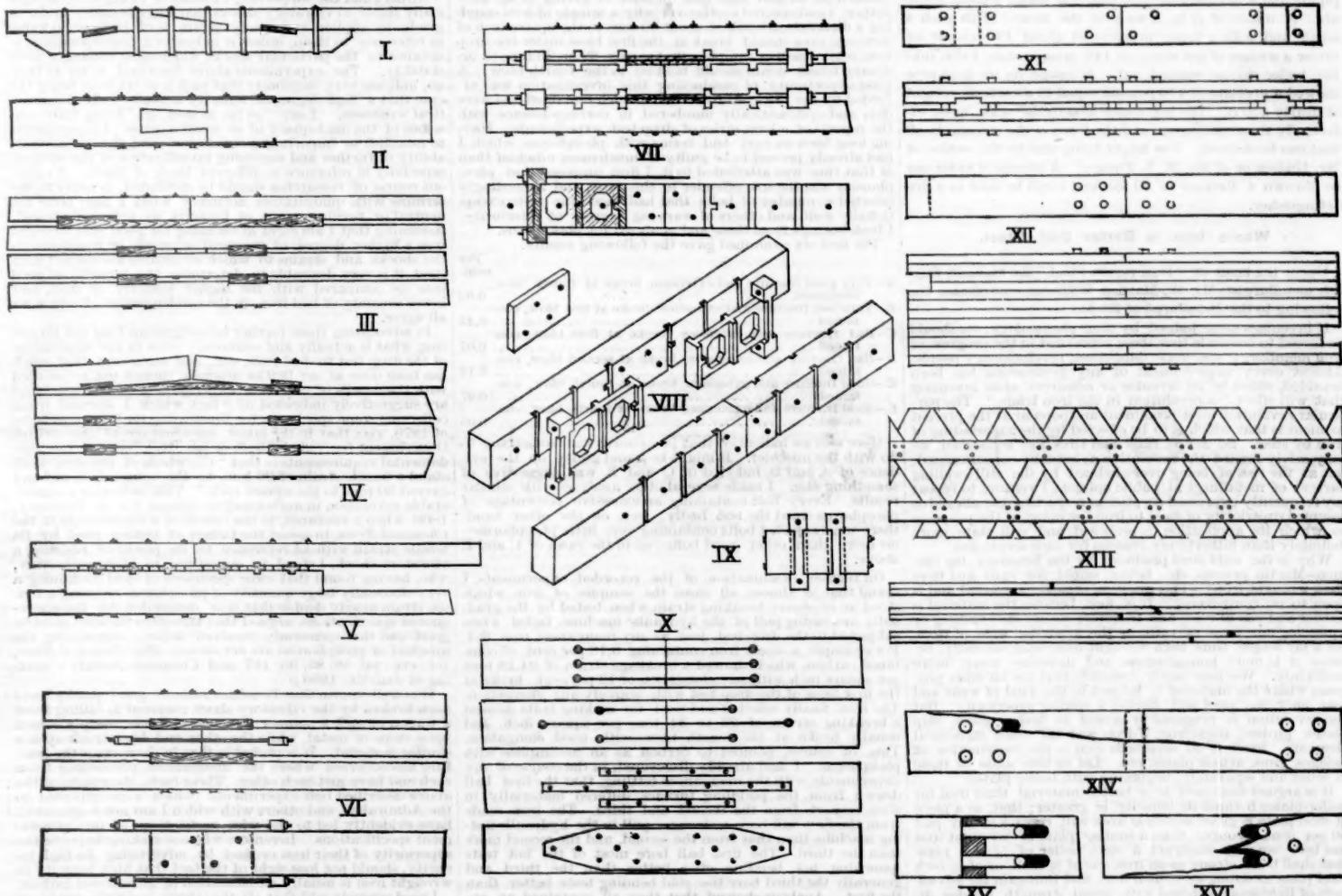
Figs. VII., VIII., and IX., show the place, sections and isometric view of a splice which has been found very good, and which retains 75 per cent. of the wood, the castings being used at the same time for packing the chord.

Fig. X. shows four several forms of the strap splice, the first being that given by Mr. Whipple, the second a modification of the same by which the stick is weakened only by a single bolt-hole, the third a different form of the same thing, in which we get more bearing between the bolts and the wood, and the fourth a still further modification of the same.

Fig. XI. shows the plan and elevation of one panel of a lower chord made of four 3×12 planks, put together with two-inch oak pins, one plank being cut in each panel. This is the plan used in the Padelford bridges, very common in some parts of Maine, New Hampshire and Vermont. By introducing a short plank into the central space, and adding a few more pins, the line of fracture will be changed, and the chord strengthened. These bridges have stood very well, just as they are; but it might be well to strengthen three or

which stood for thirty years under the continued and heavy traffic of one of the principal railways in New England. Fig. XV. is a very good example of a plain shear endways. The fractures in figs. XIV. and XV. are given as throwing some light upon the mode of failure which may be expected in a pine or spruce plank held by oak pins. Fig. XIII. shows, on a smaller scale, the plan and elevation of the central part of the lower chord, in which three joints are pulled open and three planks are broken. The plan refers to the lower line of planks shown in the elevation.

Pins are frequently, if not always, considered to fail by shearing, while as a matter of fact they do not shear, but break, or rather bend. They rarely get so far as to break. A hard-wood pin may be sheared off between two surfaces of iron, but an oak pin is never sheared when driven through a pine plank. The pin breaks down the edges of the hole, takes position oblique to the axis of the plank, and finally bends in one or more places; but as far as I know never actually gives way until the planks break. If we consider the oak pin as failing by shearing, we shall in nearly every case find a plank bridge to be deficient in pins. If we treat the pin in double shear as a cylindrical beam fastened at the ends and loaded uniformly, and the pin in single shear as a semi-girder fixed at one end and uniformly loaded, the lack of pins will be still greater. I have repeatedly asked practical builders if it would not be well to introduce more



SPICES FOR THE LOWER CHORDS OF WOODEN BRIDGES.

splice in a wooden bridge so made as to keep only one-third or even one-fourth of the original stick, while a little care will enable us to keep two-thirds or three-fourths. It is very rare, too, to see one of these splices which is equally strong in all parts. I have seen two rods, each two inches in diameter, in a splice where the stick was so cut as to leave only thirty available square inches of wood for tension; and I have seen, on the other hand, a stick 8×15 in. reduced by notching to leave 6×15 in. for tension, which was held only by two one and a half inch rods.

To refer to the sketches, fig. I. may be seen in many of our older highway bridges, the splice in some cases however being much longer than that shown in the figure. In one case which I recollect the lower stick was sixty feet in length. As the stick was a foot square, this was hanging about a ton upon the bridge for the sake of a splice.

Fig. II. is a connection used in the Forman truss upon the Reading road. It will be seen that with good proportions the percentage of the full strength of the stick retained by this splice is very high—say 80 per cent., supposing the stick to break through the notches at the end of the straps.

Fig. III. is a joint by McCallum, from the canal span at Binghamton, on the Erie Railroad. The joint is an excellent one, and is very well proportioned—much better than the form shown in fig. IV., which is sketched from an actual bridge and which shows very plainly the use of the two short bolts in fig. III. This pulling off of the outer stick is often noticed in the outside plank in lattice bridges.

Fig. V. is a splice by Maurice and Kellogg, and is certainly simple and effective. When the stringers cannot be placed so

four panels at the middle part of the span as above suggested.

Fig. XII. is an elevation and plan of one panel of perhaps the most remarkable exploit in the way of wooden bridging that we have had of late. This bridge, which was built by the late Mr. Pratt, for carrying the Eastern Railroad extension over the Saco, above Conway Corner, in New Hampshire, was a double-triangular wooden bridge of 240 feet span. The chords, ties and braces were all of 3×12 plank, pinned with two-inch oak pins. The lower chord of each side truss consisted of twelve 3×12 planks placed abreast, four of the planks being cut in each panel, while four additional planks were cut for the insertion of the ties and braces midway between the splices proper. This work being found to be weak, a second truss exactly like the first, only narrower, was telescoped into the first, thus making a plank chord six feet wide on each side of the bridge. The splice had four pins on each side of the joint, as shown in the sketch; but where the ties and braces intersected, nine additional pins passed through the chord. This chord at once pulled itself to pieces, as might have been expected, the joints at the middle of the span being open as much as two inches. It is easy to see the lack of pins in this chord. A double-triangular bridge of 240 feet span, for railway traffic, made of 3×12 plank and two-inch oak pins is not a desirable structure, but it might have been improved by cutting the planks in a different manner, and by introducing more pins.

Figs. XIII., XIV., XV. and XVI. are sketched directly from an old-fashioned lattice bridge of about 140 feet span,

pins into a chord made of planks, and have always got promptly the reply that it would not, as the additional holes would weaken the chord too much. We do not, however, by the introduction of more pins necessarily make any weaker lines of fracture than we already have, but we make a greater number of lines of fracture. Mr. Whipple remarks: "Wooden pins do not possess sufficient strength in proportion to the surface, unless made so large as to require too much cutting of the timber. Moreover, the action upon the pin tends to crush it laterally, in which direction the hardest timbers available for pins scarcely offer as much resistance as the ends of the fibres to which they are opposed." This is exactly what any one would say, and yet the fractures shown in figs. XIV. and XV. show that the pins were better able to stand the strain than the planks were; for these pins, which are now in my possession, are in almost perfect condition after thirty years' of use under railway trains. The same figures show, too, what we might expect, that the theoretical line of fracture in wood is interfered with by natural lines of weakness. Any supposed analogy, therefore, between the method of arranging the rivets in a boiler plate tension joint and the method of arranging the pins in a plank must be employed with caution.

With regard to the safe working unit strains to be employed in proportioning joints Mr. Latrobe takes 12,000 lbs. for the tensile strength of iron, 2,000 lbs. for the tensile strength of wood, 1,000 lbs. for the compressive strength against the ends of the fibres, and 100 lbs. per inch for shearing off in the direction of the grain. Mr. Whipple allows 1,000 lbs. for tension, and the same for com-

pression, and 100 for shearing parallel with the fibres. Just how much of this compression against the end of the fibres may be safely borne can hardly be stated. There are many Howe bridges where the horizontal thrust of the block at the foot of the end brace, under the average load, is at the rate of from 4,000 to 5,000 lbs. per square inch; and such thrust has been held with apparent safety for over twenty years, although 5,000 lbs. is given as the ultimate resistance of timber to compression. The 2,000 lbs. used by Mr. Latrobe for tension is double the amount that is now regarded safe.

A well-arranged and carefully-executed set of experiments for the exact determination of these units, as well as for fixing the actual breaking strength of the various tension joints, would aid us very materially in proportioning correctly these important parts of wooden bridges.

GEORGE L. VOSE.

Washing Out Boilers with Hot Water—A Locomotive Injector as a Force Pump.

[Extract of Letter from John E. Martin.]

SANTIAGO, Chile, July 21, 1878.

I notice in the discussion on boilers at the last convention of master mechanics that Mr. Hudson recommends washing out locomotive boilers with hot water.

I have used the injector for that purpose lately and with great success. We connect the boilers to be washed out with the injector of another locomotive by means of wrought-iron piping and a flexible hose pipe that will stand a good pressure. A nozzle of $\frac{1}{4}$ in. is used on the hose. With such a nozzle and with a boiler pressure of about 130 pounds we throw a stream of hot water of 140° temperature Fahr. into the boiler to be washed out. A gauge on the hose pipe showed a pressure of 110 pounds, equal to vertical weight of nearly 250 ft. The hot water loosens the scale more effectually than cold water, and the force of the stream is all that can be desired. You might bring this to the notice of Mr. Hudson or of Mr. M. N. Forney. A stream of water can be thrown a distance of 60 feet and could be used as a fire extinguisher.

Where Iron is Better than Steel.

Under the head of "Iron versus Steel," the eminent English metallurgist, Mr. W. Mattieu Williams, contributes the following to the *Metallurgical Review*:

If inventors were judged by their phraseology, we should be forced to conclude that those concerned in the progress of iron metallurgy are very dangerous, revolutionary people. Almost every improvement of any pretensions has been heralded, either by its inventor or admirers, as an invention that will effect "a revolution in the iron trade." The particular revolution most prominent and popular at the present moment is that which is to be effected by the superseding of iron by steel. So far as rails and tires are concerned, we may safely regard the revolution as actually consummated; but at the risk of being overwhelmed by the still-swelling current of metallurgical public opinion, I venture to repeat my frequently-expressed scepticism respecting the alleged or assumed superiority of steel to iron for many of the purposes to which its application is proposed, and will state more definitely than hitherto my reasons for such scepticism.

Why is the mild steel produced by the Bessemer, the Siemens-Martin process, etc., better suited for rails and tires than wrought iron? This question is easily answered and is open to no controversy. It is, first, because the material is harder and less fibrous, and therefore resists the crushing or squeezing-out wear of rails, or the grooving wear of tires, for a far longer time than wrought iron; and, secondly, because it is more homogeneous, and therefore wears more uniformly. We may safely conclude that for all other purposes where the material is subject to this kind of wear and tear only, the steel will display a similar superiority. But the revolution is proposed to extend to boiler plates, ship plates, girders, angle iron, T-iron and all other structural elements. Steel is to supersede iron in the construction of bridges, guns, armor plates, etc. Let us take some of these in order and separately, beginning with boiler plates.

It is argued that steel is a better material than iron for boiler-plates because its tenacity is greater; that, as a piece of steel plate is given sectional area will resist a steady pull 50 per cent. stronger than a similar plate of wrought iron can bear, we may construct a steel boiler of $\frac{1}{4}$ -inch plate that shall be as strong as an iron one of $\frac{3}{4}$ -inch, or of $\frac{1}{2}$ -inch steel plate as strong as $\frac{3}{4}$ -inch iron, and thus gain the advantage of lightness combined with equal strength, besides diminishing the resistance to the passage of heat from the furnace to the water. The data here stated are unquestionable. As a strip of $\frac{1}{4}$ -inch plate of fair quality of mild steel will stand a pull quite equal to that which is borne by an equally wide strip of $\frac{3}{4}$ -inch good-quality wrought-iron plate when both of these are tried by tearing asunder by a testing-machine, the above-stated conclusions appear unquestionable, seeing that the strain upon a boiler is a tensile strain, and a boiler can only burst by an actual tearing asunder of its material. In venturing to question these conclusions I am bound to state my reasons rather fully, and will do so accordingly.

In 1868 and 1869 I made some experiments which led me to suppose that I could materially improve the quality of wrought-iron by mixing oxide of manganese with the ordinary "feeling" of the puddling furnace, and I became accordingly a patent-office victim. In working this invention I tested the iron produced thereby in the usual manner, and obtained the reports which inventors usually obtain concerning the high tenacity, the extension, contraction of area, etc., of my improved iron. Just at this time the firm of Sir John Brown & Co., of Sheffield, were competing for a government contract for bolts for armor-plated ships, and the government inspector, an officer of the engineers, was at the works testing several specimens of iron offered for the purpose. Newspaper writers at home and politicians abroad commonly imagine that the officials of the British Ordnance and Admiralty departments are all of them mere *dilettante*—fine gentlemen with very little practical knowledge of mechanical subjects. My own experience contradicts this notion very positively. In the present instance the officer that came down from London paid but little attention to the tensile extension, contraction of area, etc., tests of the iron offered for bolt-making. He argued that the bolt which holds the armor-plates of a ship to their backing is not liable to such a gradually applied strain as the pull of the hydraulic press or the big screw of a testing-machine, but has to resist the sudden, tearing crash of a heavy canon-ball. To imitate this, he had the iron made into bolts of the size required, viz., 3 in. diameter. These were passed through two

pieces of armor-plate, and secured by the head of the bolt at one end and the nut at the other to pieces of armor-plate as they would be in the ship's side. The enemy's cannon-ball was represented by a weight of 1 ton falling from a height of 30 ft. between guides, and so arranged that the force of the blow was delivered on the lower plate, to which the tail of the bolt was attached by the nut, while the plate holding the head was held firmly. The blow thus effected a suddenly-delivered tearing-strain upon the bolt, acting fairly in the line of its axis, and representing the strain to which a ship's bolt would be subjected when a ball had penetrated the armor and was crashing through the backing to which the armor is bolted.

The results of this "drop test" were that bolts made of certain peculiar qualities of iron stood as many as four blows before breaking. They stretched considerably at each blow, thinning to contracted waists at certain parts, the position of which was by no means constant. At the places where the maximum stretching occurred, curious symptoms of "distress" were displayed. There were pimples and ridges on the originally smooth surface of the bolt, evidently due to the pressure of hard, unyielding portions imbedded in the more plastic material of which the bulk of the bolt was composed; showing that even the best of wrought iron is far from homogeneous. Many gave way at third, second or first blows. I am forced to confess that every bolt made from iron produced by my patent manganese-puddled iron broke most ignominiously and carrot-like at the first blow. This was the more humiliating, inasmuch as all the ordinary tests—hot and cold bends, ram's-horn test, holeing test, fractures, etc.—had given brilliant results, and the tensile breaking strain, as tested by the hydraulic machine, was unusually high, with the elongation and contraction of area quite satisfactory.

Considerable training in the endurance of disappointments enabled me to bear this; but, instead of giving it up altogether, I endeavored to discover why a sample of iron standing a direct steady pull of about 90 tons to the square inch of sectional area should break at the first blow under the drop test, while another sample only bearing 22 or 23 tons of ordinary tensile strain should hold on to the fourth blow. A good opportunity of conducting this investigation was afforded by the stock of broken bolts which remained and were duly and systematically numbered in correspondence with the reports of long series of drop-test experiments. Having long been on very bad terms with phosphorus, which I had already proved to be guilty of much more mischief than at that time was attributed to it, I first supposed that phosphorus was the sole offender in this case, and accordingly selected a number of bolts that had stood the tests exceptionally well, and others of varying degrees of inferiority. I took borings from these and analyzed for phosphorus.

The first six examined gave the following results:

	Per cent
A—Very good fracture and extension, broke at fourth blow, contained.....	0.02
B—Very bad fracture and extension, broke at first blow, contained.....	0.15
C—Bad fracture and extension, broke at first blow, contained.....	0.07
D—Bad fracture and extension, broke at second blow, contained.....	0.13
E—Good fracture and extension, broke at fourth blow, contained.....	0.07
F—Good fracture and extension, broke at fourth blow, contained.....	0.05

Here was an indication that phosphorus had something to do with the mischief. It might be found guilty on the evidence of A and B, but that of C and E was suggestive of something else. I made several other analyses with similar results. Every bolt containing an excessive percentage of phosphorus stood the test badly; but, on the other hand, there were rejected bolts containing very little phosphorus no more than other good bolts—as in the cases of C and E above.

On further examination of the recorded experiments, I found that in almost all cases the samples of iron which stood an excessive breaking strain when tested by the gradually increasing pull of the hydraulic machine, failed when subjected to the drop test, just as my manganese iron did. For example, a steely iron containing 0.18 per cent. of combined carbon, which showed a breaking strain of 34.18 tons per square inch with any elongation of 12 per cent., broke at the first blow of the drop test with scarcely any elongation. The iron finally selected and used for making bolts showed a breaking strain of 22 to 24 tons per square inch, and usually broke at the fourth blow with good elongation. This, of course, pointed to carbon as an accomplice with phosphorus. I had already discovered, in the course of my experiments with the manganese fettling, that the first ball drawn from the puddling furnace differed materially in some respects from the second and third. The iron made from the first ball bore a stronger pull in the hydraulic testing machine than that from the second, and the second more than the third. The first ball bore most of the hot tests (punching hot, bending, etc.) better than the third, and generally the third bore the cold bending tests better than the first. Analysis showed that they all contained an appreciable amount of carbon, and that this was always greatest in the first ball and progressively less in the later balls. To test this more severely, I had some beats made into four or five balls instead of the customary three. The reason of this is obvious enough. The ball of spongey, uncompressed iron, as it stands in the puddling furnace waiting its turn at the hammer, is undergoing oxidation, but the oxygen first attacks the carbon, which continues to protect the metal so long as it remains in sufficient quantity, and thus the only difference between these different balls from the same heat is their different proportions of carbon.

This supplied me with the means of making an *experimentum crucis*, by having two bolts made, one from the first ball, the other from the third ball of the same heat of "best heat" iron, puddled in the ordinary way; but the first ball was hurried off to the hammer as sharply as possible, and the third was delayed rather more than usual. The first contained nearly two-tenths per cent. of carbon; the third a barely visible trace, too small to be determined quantitatively by the ordinary method of analysis. The bolt made from the first ball broke at the first blow; that from the third at the fourth blow. They were not officially tested, but I have no doubt that had they been, the first would have been rejected and the third accepted, though both were made from the same heat. I need scarcely add that in practice the three balls are usually welded and rolled together, and thus a bar of mean composition is obtained.

The above details are given because they have a direct, and, as I think, an important bearing upon the question now occupying so much attention among the metallurgists of all nations. In the case of these bolts, the steely attributes were directly detrimental. Increased tenacity, as measured by the application of a gradually increasing strain, was accompanied by increased weakness in relation to a sudden shock. The case is an extreme one undoubtedly, and the test excessively severe; but, admitting this as regards degree, does it not represent the kind of strain to which boilers, girders, ship-plates, bridges, and all structural applications of iron or steel are more or less subject?

Let us take a boiler first. While the heat is being gradually applied, the expansive force of the steam gradually developed, and the boiler firmly at rest, the plates are submitted to a strain fairly represented by the hydraulic or screw-testing machine; but if, when the metal is thus strained, the boiler is submitted to any kind of shock, the conditions are entirely changed. A vibration traverses its structure; waves of compression and extension suddenly add to the tearing strain of the expanding steam in one place and diminish it in another. In proof of the effect of this, the following experiment may be made by anybody who has a testing machine at command. When the strain is approaching the breaking point, let the bar or plate under trial receive a light but smart tap sufficient to produce a molecular vibration. It will instantly break, even though at a considerably less strain than would have broken it if undisturbed. The boilers of all kinds of marine engines and of locomotives are subject to violent vibratory shocks. Suppose we have two boilers, one of steel and the other of soft malleable iron, and both have been tested by hydraulic pressure to the same extent. Which would be the most likely to give way under practical conditions, and subject to ordinary and extraordinary shocks while worked nearly up to their tested pressure? If compelled to sit on the safety-valve of one or the other, I should choose the soft iron.

It is well known that some of the worst cases of boiler explosions have occurred very unaccountably, as though some sudden generation of expansive force had occurred. The spheroidal state of water, its decomposition by the over-heated plate followed by explosion of the gases, and other theories, have been invented to account for these. The fact of sudden shock of some kind can scarcely be disputed, and steel plates, if I am right, would, in spite of greater tenacity to steady strain, be the weakest when subjected to such sudden violence.

Girders and the supporting element of bridges are especially liable to vibratory shocks that mere tenacity under a gradually applied and steady strain is of little or no value in reference to them, unless it indicates a corresponding resistance to the particular shocks which most endanger their stability. The experiments above described, so far as they go, indicate very ominously that such is so far from being the case that a high degree of tenacity actually indicates practical weakness. I say "so far as they go," being fully conscious of the inadequacy of so small a series of experiments to establish so important a conclusion, and the great desirability of further and searching investigation of the subject, especially in reference to different kinds of shock. A rigorous course of researches should be instituted, in order to determine with quantitative accuracy what I may term the neutral or turning point of tenacity as ordinarily tested. Assuming that I am right in claiming for good soft wrought iron a higher degree of practical strength or resistance to the shocks and strains to which structures are subject than steel, it is very desirable to determine the tenacity of good iron as compared with the higher tenacity of steel, and lower tenacity of bad iron, in the condemnation of which we all agree.

In advocating these further investigations I am not forgetting what is actually and commonly done in the application of the drop test to steel rails, etc., and am aware that much has been done at our British arsenals, though not acquainted with the details of all these experiments. Their teachings are suggestively indicated by a fact which I learned when collecting some specimens for illustrating the Cantor lectures of 1876, viz., that in the latest specifications of the British Government for "angle, bulb or bar steel" one of the fundamental requirements is that "the whole of the steel shall stand a tensile strain of 26 tons to the square inch and not exceed 30 tons to the square inch." This indicates a considerable revolution in authoritative opinion, for in February, 1869, when I ventured, in the course of a controversy in the *Chemical News*, to assert the fallacy of testing steel by its tensile strain without reference to its power of resisting a vibratory shock, I stood in opposition to high authorities, who, having found that some specimens of steel containing a very unusually large quantity of phosphorus resisting a tensile strain nearly double that now demanded by the above-quoted specifications, argued that therefore the steel must be good, and that commonly received notions concerning the mischief of phosphorus are erroneous. (See *Chemical News*, vol. xix., pp. 58, 85, 95, 117, and *Chemical Society's meeting* of Jan. 21, 1869.)

It is well known that Bessemer rails of good quality have been broken by the vibratory shock received in falling from a wagon in such manner that one end has sharply struck upon stone or metal, while the other end has struck upon a similar material. It is probable that in these cases the fracture has occurred where the undulations proceeding from each end have met each other. These facts, the results of the above described bolt experiments (which were reported to the Admiralty), and others with which I am not acquainted, have evidently led to the wise restrictions of our government specifications. Inventors who are seeking to prove the superiority of their iron or steel by advertising its high tenacity, should not lose sight of the fact that high tenacity in wrought iron is usually an indication of unremoved carbon.

I need scarcely add that all the above remarks apply to the question of iron v. steel in the construction of ships. No novel experiments are needed to show that if a ship is bumped against a rock, a soft iron plate capable of considerable indentation is incomparably safer than one of brittle steel.

Some experiments were made on the "Nettle" target ship at Portsmouth, on the 18th of December last, which are very instructive. The complex and difficult process of building huge armor-plates of 20 to 30 tons weight by welding together four or five hundred or more puddled balls, naturally suggests the substitution of a material which, besides being harder and apparently stronger, may be manipulated so much more readily. With an easily attainable modification of existing appliances, the material for such a plate may be cast in a single ingot of steel and rolled at once into shape. Many attempts have accordingly been made to substitute steel armor-plates for iron. The plates have been made, and, so far as hardness and tenacity, tested by steady strain, are concerned, they have been proved to be far superior to the armor-plates that now clothe our great ironclads. When subject to a test resembling that applied to the bolts, i.e., when exposed to the crushing blow effected by the point-blank battering of heavy ordnance—they have displayed great powers of resistance to the direct penetration of the shot, excelling the iron plates very decidedly in this respect, but at the same time revealing a far more dangerous weakness—that of cracking, splitting and even breaking up into a wreck of fragments.

The trials of Dec. 18 were upon plates specially constructed with the object of overcoming this defect, and yet retaining the unquestionable advantage of steely hardness. Messrs. Cammel & Co., of Sheffield, sent three plates: No. 1, a solid plate of very mild steel, the carbon kept as low as practicable, and treated in its manufacture with the special object of toughening or reducing the liability to crack or "star." Its dimensions were 9 ft. 9 in. by 7 ft. 9 in., and 9 in. thick; it weighed 12 tons 3 cwt. No. 2 was a compound plate: total thickness, 9 in.; 5 in. of hard steel in front, welded by a patented process to a backing of 4 in. of soft iron. It was supposed that the hardness of the steel front would resist the

first impact of the shot and probably break it up, while the iron backing would arrest the cracks or starting of the steel, and prevent their extension throughout the whole thickness of the armor, the vessel, consequently, remaining watertight, and the plates still standing to receive other shots. This plate measured 9 ft. 9 in. by 7 ft. 1 1/2 in., and weighed 11 tons 4 cwt. No. 3 was a sandwich plate, made up of a layer of steel between two of iron; the middle steel layer 6 1/2 in. thick, the front iron layer 5/8 in., and the back iron layer 1 1/2 in. It measured 8 ft. by 5 ft. 11 in., and weighed about 7 tons 16 cwt.

Competing with these was a curious complication sent by Joseph Whitworth—a plate first made up bodily of Whitworth's fluid pressed steel of low carbon. This plate was then drilled through at certain uniform distances, with holes 4 1/2 in. in diameter, and into each of these holes a hardened steel plug was screwed. Like the others, its thickness was 9 in., its other dimensions 8 ft. 8 1/2 in. by 4 ft. 1 1/2 in. These three plates, duly attached to the shield representing a ship's side, were attacked by Palliser shots weighing about 250 lbs., fired from a 12-ton Woolwich gun, charged with 50 lbs. of pebble powder.

The Whitworth plate came to grief rather speedily. I am not at all surprised at this, and am very much surprised that such a thing should ever have been constructed. In excuse for its failure, the *Times* newspaper pleads that it had not been "oil hardened," as intended. I am quite unable to understand how oil hardening or oil toughening could improve such a heterogeneous mass. If the high carbon steel pins were fully hardened before insertion, a milder hardening by oil would diminish their size without equally diminishing that of the mild steel body of the plate. If soft when screwed in, the oil hardening would expand them considerably. In the first case the resisting power of the plate would probably be diminished by the aid of the series of skillfully-initiated fractures, as a vibratory jar or sharply localized shock would occur when the vibration caused by the shot reached the lightly-touching surfaces between the plate and pin. In the second case, the expansion of the pins would subject the whole plate to a state of strain or tension at every hole, the force of which would come in aid of just the sort of rupture to be avoided, viz., a cracking across from hole to hole and consequent detachment of the intervening piece.

The composite plates, Nos. 2 and 3, both split up badly, "their complete disintegration taking place at the third shot." The only one of the four that stood the ordeal at all satisfactorily was No. 1, the homogeneous soft steel plate. This showed only a few indentations and hair cracks, with some bending inward. Like all the steel plates that have hitherto been tested, it resisted penetration better than wrought iron, but was weak in reference to cracking.

A shot may penetrate a good soft iron plate, leaving a hole not quite so large as the shot. If there is no cracking, the mischief ends there—the pierced plate still stands as at first for other shots; but a plate fractured even by hair cracks grows worse at every succeeding shot, and finally breaks to pieces.

The practical conclusion to which all the above-stated facts and reflections point is, I think, that for all purposes where resistance to vibratory shocks or suddenly-applied strains of any kind is demanded, the old-fashioned wrought iron is more reliable than steel of any kind that is at present obtainable. I do not, however, maintain that we should be satisfied with this conclusion, but, on the contrary, regard it as indicating the direction of future effort, which should be devoted to the softening and toughening of these new steels, in order to combine, as far as possible, some of their valuable properties with those of wrought iron.

This opens the interesting subject of annealing, which will be considered in a future paper.

Durable Iron Rails.

In a letter to the Secretary of the American Iron and Steel Association commenting on some comments on re-rolled iron rails, Mr. O. W. Davis, Jr., Treasurer of the Katahdin Iron Company, of Bangor, Me., writes as follows:

"Four years ago a small lot of rails were rolled for us at the Portland (Me.) Rolling Mills, from old rails and our 'Katahdin' charcoal pig iron, the rail being made substantially in the manner set forth in the memorandum of the Woodstock Iron Company and the Mobile & Montgomery Railway. These rails were laid in the yard of the European & North American Railway in this city, alternating with rails made in the same manner with anthracite instead of Katahdin iron. These rails were carefully watched and the charcoal-iron-capped rail outwore two sets of the ordinary re-rolled anthracite iron rail.

"The results were so favorable that the European & North American Railway laid 500 tons last year of our Katahdin rail, and the Maine Central Railroad laid at the same time about 1,000 tons. Another lot of 500 tons is now being rolled for the European & North American Railway, to be laid this fall, at a price about eight dollars per ton less than a Bessemer steel rail would cost laid down here."

Previously to this the *Journal of the Steel and Iron Association* had contained a letter from Mr. Daniel Tyler, President of the Mobile & Montgomery Railway Company, in which he said:

"Agreeing with you that the amount of traffic, the position of railroads in reference to the steel manufacturers as connected with freight to and from the railroads, and the quality of rails are the important items to decide the use of steel or iron rails; and, managing a railroad—the Mobile & Montgomery—far removed from the steel-rail manufacturers, involving a cost of from four to six dollars per ton freight, while the iron rail manufacturers are contiguous to our road, involving an expense of say one dollar and fifty cents per ton; and, from the fact that English iron rails are now on our road, and in use, that were laid in 1860; and, that we have the best charcoal iron manufactured in our vicinity, I decided that it was the policy of our road to use iron rails, and within the last three years we have laid 5,000 tons of iron rails, most of them manufactured under a contract, copy of which I herewith inclose, the conditions of which have all been efficiently adhered to; and I am confident the iron rails furnished under this contract will be little, if at all, inferior to the steel rails now turned out by the Bessemer process."

With this letter was the following memorandum, under which rails have been made for the Mobile & Montgomery Company, by the Woodstock Iron Company, of Alabama:

"The party of the first part agrees to deliver to the party of the second part on board the cars, in the city of Montgomery, 1,500 tons of old rails; and the party of the second part agrees at its own cost and charge to transport the same to the city of Atlanta in the state of Georgia, and to convert them into a pattern agreed on, herewith attached, 56 lbs. to the yard, and adding thereto 33 per cent. of cold-blast Woodstock charcoal iron, which it is stipulated shall be worked skillfully into the top part of the rail so as to construct the head exclusively of Woodstock charcoal iron; and it is agreed that the said rails shall be made and manufactured as follows:

"1st. The Woodstock cold-blast iron shall be puddled in a

skillful manner, and worked into slabs by the muck-bar being cut and piled and reheated and rerolled into plates say seven inches wide, one inch thick, and of a proper length to form the pile from which the rail is to be rolled.

"2d. The best of the old rail shall be selected and cut and piled and rolled into slabs of proper length and thickness to form the bottom and flange of the rail. The bottom of the rail shall be cut, piled and rolled as above to form the part between the head and flange.

"3d. The pile as above constructed shall be well treated and passed through the rolls so as to insure a perfect weld, and rolled to a finished rail. The finishing process shall be done at a red heat so as to insure hardness and smoothness of the rail. The pile shall be made of sufficient size, so as to admit of three feet in length, to be cut off each end of the rail, so as to insure perfect and solid ends; and the whole rail shall be straightened and punched in a suitable manner for fish-bar fastenings. The said rails shall be rolled in lengths of 30 ft.; less 10 per cent., which may be in lengths of not less than 25 ft. All of the above rails shall be finished in the best manner, and be free from cracks, flaws or defects of any kind."

The fourth article specifies that the iron company shall deliver the rails in Montgomery, and names the terms of payment which were to be at the rate of \$25.50 per long ton.

The fifth article stipulates that the iron company shall guarantee every rail for five years, and replace all defective ones.

Commenting on Mr. Tyler's letter and specifications, Mr. W. E. C. Coxe, the well-known Superintendent of the Philadelphia & Reading Rolling Mill, the high quality of whose rails has been noted heretofore in these columns in extracts from the reports of the Philadelphia & Reading Railroad, writes as follows:

"It is with much interest and gratification that I read in your issue of 9th inst. the letter from Mr. Tyler, and the specification for the re-rolling of iron rails for the Mobile & Montgomery Railway. If the same care was exercised by the buyers and users of rails that Mr. Tyler has displayed in contracting for the manufacture of the rails for his road, iron rails would not be so indiscriminately denounced, but their worth would be more readily ascertained in comparison with steel rails.

"In a general way the specification under which iron rails are made for the Mobile & Montgomery Railway is very good. Several modifications might, in my opinion, be made which would tend materially to improve the quality of the rails, and make the process somewhat similar to that adopted at the Philadelphia & Reading Rolling Mill at Reading, Pa., in the manufacture of the rails which are branded "P. & R." and used so largely on the Reading Railroad.

"I would suggest that the head-bar might be improved by one more heating and rolling; if the size of the rolls in the mill will admit of it, a larger rail pile is desirable, nine inches square section being preferable to seven inches, making the iron, by reason of its greater reduction, denser, and consequently harder and tougher in the finished rail. The reheating of the rail pile after it is drawn down in the rolls to a bloom is a valuable feature in the way of perfecting the welds. This method has produced most excellent results on the Reading Railroad. The cutting off of three feet from each end of the rail is unnecessary, as one-half that length has been found to be ample sufficient to secure perfect and solid ends to the rails, with a very small percentage of short bars.

"Very few purchasers of rails make any inquiry as to the specification by which rails are made, but accept the lowest bid, not knowing, or caring, how or of what they are made.

"The practice has been too common to buy only the cheapest rails without regard to their quality, and, when condemnation follows, the conditions on which they were bought are forgotten, and the iron, because it was not properly selected and manipulated, is apt to lose its good name.

"We have statistics to show what amount of traffic the best-made iron rails will endure before they can be considered as worn out. At the present time first-quality iron rails can be bought for say \$10 per ton less than steel rails, so that it is a matter of easy calculation for the railroad manager, engineer or builder, with an estimate of the tonnage carried by his road annually, to determine whether well made iron or steel rails are the most economical for him to place in his tracks.

"Iron rail-makers who are careful to maintain the character of their product welcome a buyer, no matter how particular he may be as to details, who is willing to pay a slight margin for a good article rather than save a few dollars per ton by purchasing rails carelessly made, which will not prove half as serviceable as those manufactured according to a properly drawn specification. Such manufacturers are glad to work for an honest fulfillment of a contract which will establish the reputation of their iron rails."

The Substitution of Iron for Wood in Car Construction.

At a regular meeting of the Master Car-Builders' Association, held at No. 113 Liberty street, New York, Thursday, Nov. 21, 1875, at 7 p. m., President Garey in the chair.

THE PRESIDENT said: Gentlemen, the subject for discussion this evening is the substitution of iron for wood and steel for iron in car construction. Mr. Albert F. Hill has very kindly consented to talk to you a little this evening, and I have the pleasure of introducing to you, gentlemen, Mr. Hill.

PAPER BY MR. A. F. HILL, OF CINCINNATI.

MR. HILL.—Mr. President, Gentlemen: The development of the iron and steel industries of the country during the last twenty years, together with the improvements made in every kind of appliance and, also, for the better handling, casting, forging, rolling and finishing of even the heaviest masses of metal have, of course, made their influence felt in almost every department of our railway service. It will be safe to assert that bridge construction and locomotive building have felt this influence most. Certainly it would be hard to point out any other department in which vaster progress and more marked improvements have been witness.

The improvements made in the construction of rolling stock, during the same period, while they are probably no less extensive nor less marked, have followed a different direction; and are far more noticeable in passenger than in freight cars.

The improvements in modern bridge and locomotive construction have all been in the direction of *diminution of dead-weight*, with a simultaneous *increase in effective strength and durability*. This has been effected chiefly by the substitution of iron for wood and steel for iron, by the concentration of material along the line of strain, and careful attention to the simplicity, strength and appropriateness of details and connections.

Not so in car construction. Leaving out of consideration,

for the present, the improvements made in running gear, it becomes noticeable at once how few and immaterial the changes are which have been made in the construction of the bodies.

While in passenger coaches the greater beauty of design, the more artistic and also more expensive interior finish, the improvements in upholstery, head lining, ventilation, heating, safety-platforms and brakes, will at once attract attention. A closer examination soon reveals the fact that the original principles of frame construction have not shared the progressive movement, but are still rigidly adhered to in most instances, or, at best, are but little changed. In other words, that while these improvements have vastly added to the comfort, luxury and safety of the passengers, they have also proportionately increased the ratio of dead load over carrying capacity, and consequently the operating expenses of passenger traffic.

And these observations hold good to even a greater degree as regards rolling stock for freight. In fact, but few and limited attempts seem to have been made at improving this latter class of cars.

The cause of this seeming neglect is inconceivable, especially when it is remembered that the freight car is *per se* the "bread-winner" of the road, and of far greater importance and consequence in railroad economy, than either the palace car or passenger coach. This will be readily appreciated from the fact that from 80 per cent. to 75 per cent. of the gross earnings of trunk lines are derived from freight receipts, and that the demand for freight transportation has far more rapidly increased than the demand for passenger transportation.

In 1850 the earnings of all the railroads in the United States were \$39,466,958, of which \$20,192,104 were for freight, or about 51 per cent. of the entire receipts.

In 1872 the total earnings were \$473,941,055, of which \$340,931,785 was for freight, or about 72 per cent. of the whole receipts. That is, the ratio between passenger and freight traffic, in 22 years, has changed from 51 to 72 per cent. of the gross earnings, and probably within a year, it is safe to assert, as late in the year as we are now, that our next year's annual reports will show that it has reached all of 75 per cent.

To this constantly-increasing demand for freight transportation is added the fact that the carrying capacity of the present freight car is, as a general rule, so limited that on an average for every paying ton of freight at least one ton of dead weight has to be hauled, it becomes at once apparent how important a subject in railway economy is the proper construction of freight cars, and of how great value any improvement must be which should effect simultaneously a decrease of dead weight and an increase of carrying capacity.

The subject being one deserving the careful consideration of every railroad man in general, and of your Association in particular, I have done myself the pleasure of bringing it to-night to your attention, gentlemen, not with any thought that my views will be of any great advantage to you, but in the hope that an exchange of ideas on and a full discussion of the subject in this place may possibly result in some initiative step toward a much-needed and most desirable improvement.

It is evident that, with millions upon millions of tons of freight going over the roads of this country every year, and with just as many million tons of dead weight having to be hauled with them, any improvement which will bring about a change in the ratio between dead load and carrying capacity for the better—in other words, which will cause decrease of dead weight and increase of carrying capacity—must be of enormous benefit and of enormous value.

Remembering that the same mechanical principles which govern the design and construction of a bridge hold equally good in the construction of a roof or a warehouse floor, etc., there can be no impropriety in considering a freight car-body as a perambulating bridge, or a bridge on wheels. Conceding this view of the subject to be tenable, it will not be difficult to determine the proper principles which should govern and the proper materials which should enter into the construction of freight cars.

The tendency to substitute iron for wood in engineering and architectural structures has of late years steadily increased, until at the present time the wooden railroad bridge has become the exception and the iron bridge the rule, and it will not be long before steel will supersede the iron in large spans.

In our cities iron buildings or stone buildings with iron floors supersede every year more and more brick and wood.

Durability, strength, lightness and elegance of construction, as well as true economy, are the principal qualities by which metallic structures commend themselves.

Applying this to car construction, I think the point of greater, in fact considerably greater, durability will be readily conceded.

Unfortunately, no reliable or rather *positive* information as to the life of freight cars seems obtainable, under our present system of freight service, and the continual interchange of cars over the different lines.

Still, barring accidents of course, it will be safe to assume the life of a car-body to vary from eight to ten years at the most. There are some few instances of greater durability on record, but mostly on roads which have but light freight traffic and less interchange over other roads.

The life of a metallic car, on the other hand, may safely be estimated at from 35 to 40 years.

In order to make any comparison of strength at all, it will be advisable to confine this discussion to the comparison of some one kind of standard car, say, for instance, a New York Central & Hudson River Railroad box freight-car of the standard adopted Jan. 1, 1876, with a similar car proposed to be built of steel and iron.

The general features of the New York Central & Hudson River Railroad box freight-car may be shortly summarized as follows:

Length over all.....	29 feet.
Width over all.....	8 ft. 8 in.
Height (bottom of sill to top of plate).....	7 " 3 "
Door opening.....	5 "
Cubic contents.....	1,344 cubic feet.
Available space, say.....	1,000 "
Carrying capacity.....	12 tons.
Weight of trucks.....	9,200 lbs.
" body.....	12,800 "
Total weight of car.....	22,000 lbs.
	11 tons.

Now here we have a car which, as a wooden car, in all the details of its construction, is certainly a very good car, and in order to carry 12 tons of freight with it we have to haul 11 tons of dead weight with it. I do not wish to make here any proposition which would imply any desire on my part to make too radical a change, and so I will confine myself to simply taking this car and changing it piece by piece gradually into a metallic car. When I have done that, if I have increased its carrying capacity, first; next, if I have decreased its dead weight—or, in other words, if it is possible, by substituting iron for wood, and, in some instances, steel for iron, I can bring about this much-wished-for result—increase my carrying capacity and decrease the dead weight, we have gained much.

Starting with the supposition that it is desired to construct

a metallic freight car 29 ft. long by 8 ft. 8 in. wide with 6 ft. clear inside and carrying capacity of 20 tons, the question arises, what changes will have to be made

1. In the trucks,
2. In the frame of the body,
3. In flooring, siding and lining, and
4. How will these changes affect the ratio of dead weight to the carrying capacity?

Reverting to our simile of a "bridge on wheels," I must pay attention, first, to my trucks; for the trucks represent to us abutments on which the bridge rests. Where are my abutments? Now, I want to carry on a bridge which is 29 ft. long and about 19 ft. in the clear between abutments, 20 tons. Each abutment receives one-half of the load; in other words, on each truck will be contained 10 tons of the movable load, or the paying freight. There will be, also, on my abutments, or my trucks, one-half the dead weight of the car. I may state here that the dead weight of that car will not exceed 10,000 lbs.; consequently each truck will have to carry 25,000 lbs. In order to see what changes are necessary, I think the best plan will be to commence with the trucks. Now this truck here is as nearly an iron truck as can be constructed: every part of this truck is of iron with the exception of the transom timbers.

Now the first change I should suggest to carry that 25,000 lbs. will be in the transom. I have got here two timbers $10 \times 4 \frac{1}{2} \times 81$ long, and one timber $8 \frac{1}{2} \times 7 \frac{1}{2} \times 69$ long, weighing in all about 400 lbs. Now, these timbers I want to do away with at once and change them into channel-bars and make box girder.

The problem I have to deal with is a very simple one. I have the king-bolt plate here, and on that king-bolt is concentrated my 25,000 lbs. I have to carry that 25,000 lbs. on a beam 5 ft. $4 \frac{1}{2}$ in. in the clear. The calculation is a very simple one. I have a box girder for about 4 $\frac{1}{2}$ in. in the clear, with a concentrated load of 25,000 lbs. in the centre. Taking out the heavy oak timbers with their heavy castings, I can replace them with the light box girder, composed of plates, angles and channel-bars; those bars are again supported on the side frames on which they rest. Each of those side frames must have one-half of the load, which is concentrated in the centre of the transom. We have called that weight 25,000 lbs., on a truck modeled after the New York Central & Hudson River Railroad pattern. Consequently, we have in each centre of the said frames 12,500 lbs. This is supported at a distance of 5 ft. from centre to centre of axle.

Again, here is the problem: Find a metallic girder which will carry, with 5 ft. clear span, 12,500 lbs. in its centre. This again rests upon the bearings, which again come upon the axles. Now, having changed the timber transoms to a box girder, it does not follow that this side-bar frame here need necessarily be changed, but I think it would be advantageous to do so. It would save material to change it also to a light box girder.

Now the next thing we have to inquire into is our axles. Each of those axles will have now to bear one-quarter of that load. Those are the four points. Well, the bearing surface of the axle being 90 lbs. to the square inch of a bearing surface, we find the Master Car-Builders' standard pattern of axle to be more than sufficient for the purpose required. There is no necessity whatever to make any change on your axles. They are strong enough to load each of your trucks with 25,000 lbs. It is a question whether in the future it will not be proper to consider if it is worth while, for the sake of durability, to exchange the hammered iron axle for a steel axle. In taking this truck here and the dimensions given to it by the specifications, and calculating the absolute safe carrying load of that truck, I find that it will safely carry 20,000 lbs. as it is. I find also, on calculating the frame, or the strength in the frame of the box car, that with thoroughly sound timber and perfect workmanship there ought to be no difficulty in carrying in that car, with perfect safety, say about 15 tons. I don't think the car would stand it very long to carry much more than that, but I think this car would be safe to carry 15 tons as it stands, and the trucks are good for 20,000 lbs. each. But with the change I have proposed, I obtain a truck which is now capable of carrying, with perfect safety, 25,000 lbs. Calculating the dead weight of my channel-bars, angle plates and wrought iron, which are different for only those parts in which a difference now has been made, against the standard truck, I get the following results: AXLES, wheels and springs, as per New York Central & Hudson River Railroad specification, 2,875 lbs.; paint, oil and waste, as per New York Central & Hudson River Railroad specification, 26 lbs. But instead of getting 400 lbs. for oak timber and over 600 lbs. of cast iron, I get now 750 lbs. of rolled iron, 456 lbs. of wrought iron, and only 240 lbs. of cast iron, with a small portion of wood, giving me total result of 4,350 lbs. for the weight of this truck, or for two iron trucks, 8,700 lbs., against the weight of two combination trucks, 9,200 lbs. That is, I have got an iron truck which is capable of carrying 25 per cent. more of safe load, and weighs 500 lbs. less.

Now in regard to the car-body. Reverting again to the specifications, I have two pine sills $4 \frac{1}{2} \times 8 \times 29$ ft. long; four intermediate floor timbers 3×3 , 25 ft. long; two centres 4×8 , 28 ft. long. That is the frame, to which belong the two end sills, which are of oak, 5×8 , 8 ft. long; two middle beams and the truss rods, buffer timbers, buffer and buffer block. These are all the parts which constitute the frame. This frame weighs, without the floor of course, a little over 4,000 lbs.; with the floor on, the weight is about 5,500 lbs. Considering the car as a bridge and remembering that as long, or within reasonable limits, as I am not obstructed in my choice of depth of truss, the more I increase my depth of truss the more material I can save, there is no reason why I cannot make the side of the car, instead of trussing under the frame, one truss of 6 ft. 5 in. depth. Now I have increased my height of truss seven times very nearly by it, and of course I shall abandon at once every stick of timber there is in that frame and change it into iron. I should suggest to make the outside sills of steel the bottom chord of the truss, and this bottom chord has to carry the floor system and the load; that is, I have got a bridge where the load is on the lower chord. I have got the bridge itself on a pivot with 19 ft. 4 in. in the clear. The top chord I propose to utilize in the same way as is the plate in the wooden car. Intermediate timbers I propose to do away with altogether. I have got here a distance of 19 ft. 4 in. in the clear, or, in other words, from abutment to abutment. I take the height of my car to be 7 ft. In other words, I utilize from bottom chord to top chord. I ought to make this 6 ft. 5 in. as the height of truss from centre to centre of chord. This truss is divided into three square panels, of 6 ft. 5 in. each; and here is my first portion of the truss. Now I have to take care of the end parts. The end parts may be regarded in the light of a beam supported at one end and uniformly loaded; or the whole truss may be considered in the light of a continuous girder with the intermediate supports 4 ft. 10 in. from the end. I have now to provide here for my door posts. I have also to provide against a strain here on the end and for the counterbraces or for the greatest stability of my end post by a third brace. Here is the side frame of the car. The centre panel is without any bracing, so as to leave it free for the door opening. The whole truss or side of the car I should propose to make a riveted truss, using channel iron

for top and bottom chords and flat bars, I beams and angles for centres. Let this represent the horizontal projection of the lower chords. For the end sills I propose again to use channel bars and to face those channel-bars with timber, this timber to be bolted on and through on to the chords. There are no intermediate floor beams; there are only two centre floor beams. Now, in regard to the floor system, I propose to use I beams, taking the inside of the length of the car to be 28 ft. in the clear. I propose to use as in my floor system 3 in. I beams—the very lightest kind of I beams—and on the top of those I beams with the outside channels $7 \frac{1}{2}$ in. high, I propose to lay down longitudinal floor stringers, yellow pine, 2×5 in., and exactly one foot apart from inside to inside. Eight of these floor beams run now from end to end, supported by the I beams. Underneath and on these can be placed the ordinary $1 \frac{1}{2}$ in. floor, which is used in the box car.

Now, in regard to the buffer, I propose to use no buffer timber, being myself a great advocate of the continuous draw-bar; and to use simply a buffer block here in front, and that, with the timber in front of the channel-bar and the floor, is all the wood work that I propose to use in the whole car. I propose to use a steel roof, not only because I believe it more durable, but also because I think it is the best roof and the lightest kind of roof; and I propose to inclose the whole car in sheet iron, with the angle bars and T bars of the truss system inside properly riveted and painted. I don't believe that there is any necessity for any inside lining.

I have made a rough calculation of the weights in that car, and I get the following results: (Some of these are accurately calculated and others only approximately, but near enough for all practical purposes.) I get two trusses weighing 1,680 lbs.; rolled and wrought iron, 1,760 lbs.; cast iron, 300 lbs.; wood, nearly 4,000 lbs. I think I might be able to do it with considerably less wood yet, but I have assumed the same floor system that is in this car, and that, with the end oak timbers, and buffer blocks, and some inside lining runs up to 4,000 lbs.; and of sheet iron, 2,260 lbs.; making a total of 10,000 lbs. Now this car stands thus: Approximate weight of body, 10,000 lbs.—and the weight of the car will fall within that; it can be constructed with less; then for two trucks 8,700 lbs., making a total of 18,700 lbs. for the whole car *ready for use*, with a carrying capacity of 20 tons. The wooden car which has served in its general dimensions and general arrangements as a model for this metallic car has a carrying capacity of 12 tons, and a total weight of 22,000 lbs. Granting that this wooden car when new and in good condition can carry 15 tons, though I think that this is the maximum that ought to be put in that car, we have increased the carrying capacity of the car 25 per cent. and reduced the dead weight nearly the same amount.

This is a subject which I do not think any one man could do justice to in a single evening, and I do not propose to occupy your time any longer, gentlemen, and to fatigue you and wear you out with the subject; but I will say this: that a metallic car, constructed as this is, will effect just such savings as indicated here, is open to the calculation of every one of you. There is no difficulty in calculating these strains and in getting the amounts of metal that are necessary for those strains. Where the real saving in metallic cars will come in will be by lengthening them out, and lengthening them out considerably. With every foot that you add, you will not only increase your carrying capacity, but, if you will go far enough—and I will say here that my idea of a good metallic car is at least 45 ft. long—you will not only increase your carrying capacity for that foot, but you will decrease dead-weight in still greater proportion. This car is altogether too light a car to employ steel in sufficiently large quantities in it; but get a truss 45 ft. long and give that car a carrying capacity of at least 40 tons, and you can take advantage, in almost every member of that truss, of the greater tensile and compressive strength of steel.

Much remains to be said on the subject, but I have limited myself to simply giving an outline of the way in which construction can and ought to be influenced.

I beg to thank you, Mr. President, and all you gentlemen, for your very courteous attention.

At the conclusion of Mr. Hill's address, the society tendered him a vote of thanks.

REMARKS BY MR. CHARLES H. KELLOGG, OF THE KELLOGG BRIDGE COMPANY, BUFFALO.

Mr. President and Gentlemen:

I beg to be excused from making lengthy remarks on the subject of discussion, as I came here to learn your views upon the question and to lay before you my plans and models of all-iron cars. But let me say that I concur entirely with the previous speaker, Mr. Hill, and, as a curious coincidence, will call to your attention the fact that, although not having had the pleasure of his acquaintance until a few moments since, and knowing that he could not be in possession of my manner of substituting iron for wood in freight cars, Mr. Hill's remarks are a perfect description of my plans and models, until we learn the body of the car.

We both, working hundreds of miles apart upon the same subject, have reached the same result: therefore, as I remarked at the outset, I thoroughly agree with him. The saying that there is no better way to reach the attention of railroads than through their pockets, reminds me that perhaps a few figures, hurriedly made here, may be useful in showing the value of strong, light cars, whether made of wood, iron, steel, or any other substance, the only requirement being strength (embracing durability) and lightness. One of the plans presented here by me is for a 28-ft. platform-car, all iron excepting the brake, beams and flooring. The breaking load is calculated at 120 tons.

The working load at 20 tons.

And the dead load is 8 tons.

Now, we have seen from the data presented here to-night that the weight of a standard New York Central car is about 9 tons, and its capacity or working load is 12 tons. Now what have we? Take a train of ten cars of each, and in one train of iron cars there are 80 tons of non-paying freight and 200 tons of paying freight; and on the other there are 90 tons non-paying and 120 tons of paying freight. Reducing these to dollars we have:

200 tons, at \$1.00 = \$200, receipts from iron cars.

120 tons, at \$1.00 = \$120, receipts from wooden cars.

On the return trip, if both trains are light, that of wood cars will weigh one ton per car more than that of iron; therefore, to bring the cost of returning both trains to one basis, I must load each iron car with one ton of paying freight, which, at the rate named before (\$1.00) makes \$10 in its favor. Therefore, from experience with the two trains on one trip, we have for iron cars:

200 tons paying freight, going, at \$1.00 = \$200

10 tons " " returning, at \$1.00 = \$10

Total = \$210

and for the wood cars we have:

200 tons paying freight, going, at \$1.00 = \$200

10 tons " " returning, at \$1.00 = \$10

Total = \$210

Difference in favor of ten iron cars = \$00

Difference in favor of one car = \$00

Another important saving will be in the men required to handle the train, as, if heavier loads are carried, fewer cars

and consequently less men to handle them will be necessary.

Adjourned to the third Thursday in December.

RAILROAD LAW.

Liability of Carrier to Rightful Owner of Stolen Property.

In Lissberger against the Chicago & Alton, one Seibold carried away a Fairbanks scale belonging to plaintiff and shipped it over defendant's road to Dwight, Ill. The plaintiff demanded the property, and on investigation the company became satisfied that the property belonged to him, and offered to return it on condition that he would pay the freight charges from Chicago to Dwight and return. This he refused to do, and brought an action in *tresor*. The lower court decided in plaintiff's favor, and now the Illinois Appellate Court in Chicago has affirmed the decision, as follows:

"We think that Seibold, having no lawful right or authority to the possession of said property, could, of course, give no more right than he himself had, and that, as a consequence, the company acquired no right to receive or ship the property, and that, having done so without legal protection, it was its bounden duty, upon demand, to return the property to the place where it received it, and deliver the same to its rightful owner, the appellee, and that, too, without terms or condition upon his part, and, not having done so, we think that the finding of the court below was correct, and that in the record there was no error, and therefore the judgment is affirmed."

Limitation of Time on Commutation Tickets.

In Lillis against the St. Louis, Kansas City & Northern Company, appeal from the Jackson County (Missouri) Circuit Court held:

1. When the holder of a thousand-miles railroad commutation ticket, expressed to be "good for six months only," after that period has elapsed, having first obtained legal advice that the ticket was good until the thousand miles were traveled, and before the ticket was exhausted, took his seat in the baggage car of a train, refused payment of fare, otherwise than by offering his ticket, and was forcibly ejected from the train: *Held*, That the ticket was void; that the holder was not a passenger, but became a trespasser upon his entering the baggage car, and upon his refusal to get off might be ejected, with the use of any force necessary to that end, and at a point contiguous neither to a station nor dwelling-house; that the statute had no application to such a case.

2. Instructions not warranted by the evidence are properly refused.

THE SCRAP HEAP.

Railroad Manufactures.

The Railway Speed Recorder Co., at Kent, O., has been obliged to buy more tools for its shop, in order to keep up with the orders received.

The Altoona (Pa.) Rolling Mill is running full double turn, with a full force employed. A new guide mill is being put up.

The Wabash Railway Shops, at Toledo, O., are building 50 new box cars 33 ft. long, and a new directors' car.

The two furnaces and other buildings of the Mingo Iron Works, at Steubenville, O., with 237 acres of land, were sold Nov. 20, and bought by the first-mortgage bondholders for \$87,000. The second-mortgage was \$75,000; other debt, \$285,000.

Hirom Furnace, at Youngstown, O., turned out recently 468 tons of iron in one week, using Wampum ore exclusively.

Tecumseh Furnace, in Cherokee County, Ala., made in October 656 $\frac{1}{2}$ long tons of pig iron, of which 522 $\frac{1}{2}$ tons were No. 1 foundry iron, and the rest No. 2 foundry and gray mill. The stack is 60 by 12 ft., closed top and hot blast; ore, brown hematite, and fuel, charcoal.

The Harrison Wire Co., at St. Louis, has recently enlarged its works.

The St. Louis rolling-mills are reported all busy at present.

The iron works in and near Wheeling, W. Va., are all running.

The L. B. Flanders Machine Works in Philadelphia have recently shipped a crank-pin machine to the Northern Pacific road and a cylinder-boring machine to the Oregon Steam Navigation Co., and are making another for the same company. The works are now making Farley's patent steel flue brushes.

The Reading (Pa.) Iron Works have started up their sheet mill on orders.

The Philadelphia & Reading Rolling Mill, at Reading, Pa., recently made 138 tons of iron rails in one night turn.

The Wabash Rolling Mills, at Terre Haute, Ind., are running to their full capacity on orders.

Riehle Brothers, of Philadelphia, are now making a new machine for testing wire, which is also adapted to test samples of iron and other metals. A hydraulic pump is used to produce the strain. The machine is placed on a stand, and is compact and convenient. It is 3 ft. 9 $\frac{1}{2}$ in. long, 2 ft. 3 in. wide, 4 ft. high, and weighs 890 lbs.

The Cedar Point Iron Co., whose furnaces are in the Lake Champlain district in New York, have contracted to sell all the Bessemer pig iron the furnaces can turn out until next June.

The Allentown (Pa.) Rolling Mill Co. has its merchant iron mill running on orders. The company will soon put an additional blast-furnace at work.

The Iron Clad Paint Co., at Cleveland, O., has filled orders since Nov. 1 for the Lake Shore, Wabash, Central Vermont, Boston & Albany, Cincinnati Southern, St. Louis, Iron Mountain & Western, and other roads, and the Keystone Bridge Co. The company has now the necessary facilities for furnishing its paint ground in oil ready for use.

The New York Central & Hudson River Company is now putting in its passenger cars the Hitchcock patent lard-oil lamp, manufactured at Watertown, N. Y. It is claimed that one of these lamps gives a light equal to eight of the candle-burners now in use.

Notice is given by the Register in Bankruptcy that a meeting of the creditors of the McNairy & Claffin Manufacturing Co. will be held at No. 11 Case Block, Cleveland, O., Dec. 20, at 10 a. m., to consider a proposition for a composition of the debts of the company.

Bridge Notes.

The Lynchburg Iron Works, at Lynchburg, Va., have added iron bridge building to their other work. The first contract was for a highway bridge at Lynchburg, a quadrangular truss 235 feet long, in three spans, and one or two other contracts are expected.

The Clinton (Ia.) Bridge Co. is building 10 bridges, eight of which are iron and two combination truss bridges.

Larkworthy & Burge, of Quincy, Ill., are building three Howe truss bridges for the Quincy, Missouri & Pacific road.

The Buckeye Bridge & Boiler Works, at Cleveland, O.,

have closed a contract for four wrought-iron bridges for Erie County, Pa. They are also making a 500-barrel oil still and a 1,000-barrel bleacher for a Philadelphia firm of oil refiners.

Notes.

Actual dialogue on Broadway: Polite Englishman to Gothamite—"Aw, I beg your pardon, but will you be so good as to inform where the elevated road is?" Gothamite—"Two blocks west and one block up, if you wish to reach the nearest station—that at Twenty-third street." Polite Englishman—"Aw, thank you, thank you; ever so much obliged. Aw, d'ye know your elevated roads here ain't at all like our elevated roads in Lunnon? Aw, not at all. Ours are all under ground, you know."—*New York Sun*.

How our old friends come round again! The familiar story about the countryman who hitches his horse to a train comes to us as usual this fall, this time from Xenia, O.

When Levi Isbel pulled up at the Ottawa water-tank a few mornings since, he noticed the glass of the headlight to his engine, 135, broken, and on examination found inside an owl, which it had evidently struck while running. The bird being only slightly hurt was brought up by Matt Kennedy and presented to Hank Hoppa.—*Aurora (Ill.) Beacon*.

"Supper is now ready in the smoking car," shouted the brakeman, and a young man from Hartford, who was on his way to San Francisco, got up and went forward to see what the brakeman meant. He went into the smoking car and found a party of Bavarian emigrants cooking two kinds of cheese and three denominations of sausages on the stove. He came out very pale and gave the brakeman half a dollar to stand on the platform and burn matches under his nose. "Was it very bad?" an old gentleman asked him, when he returned to the coach. "Sir," said the young man of Hartford, "you'll never smell anything like it until you have been dead about six months."—*Burlington Hawkeye*.

Prices of Rails.

Prices of steel rails are reported as somewhat unsettled, with several large buyers seeking to place orders at the best possible prices. There are reports that very low prices have been accepted for winter delivery, but they need confirmation. Philadelphia quotations are \$42 to \$44 per ton at mill, with some concessions to large buyers.

For iron rails an active demand for light rails is reported, with several sales to go to Cuba. Philadelphia prices are \$33 to \$36 at mill.

Old rails are in light demand, with sales of some small lots at \$19.50 and \$20 per ton.

ANNUAL REPORTS.

Naugatuck.

This company owns a line from Stratford, Conn., to Winsted, 57 miles, and its trains run over the New York, New Haven & Hartford track from Stratford to Bridgeport, four miles. The company furnishes train service to the Watertown & Waterbury road, 4½ miles. The report is for the year ending Sept. 30, 1878.

The general account is as follows:

Stock (\$35,088 per mile)	\$2,000,000.00
Accounts and balances	20,685.63
Profit and loss	309,002.16
Total	\$2,329,697.79
Construction (\$37,946 per mile)	\$2,162,931.77
Cash, balances due, etc.	166,766.02
Total	2,329,697.79

The company has no funded debt and no floating debt except the ordinary current balances, which amount to less than the cash and notes on hand.

Train mileage for the year was: Passenger, 88,879; freight, 147,659; other, 32,854; total, 269,322 miles, an increase of 10,675 miles, or 4.1 per cent. over the previous year.

The earnings for the year were as follows:

1877-78	1876-77	Inc. or Dec.	P. c.
Passengers	\$176,370.17	\$176,972.06	D. \$602.49 0.3
Freight	278,391.04	301,633.60	D. 23,292.56 7.7
Express and mails	16,702.00	17,094.10	D. 301.50 2.3
Other sources	6,370.23	7,946.61	D. 1,576.38 23.0
Total	\$477,834.04	\$503,666.07	D. \$25,832.03 5.1
Expenses	249,434.54	275,739.64	D. 26,305.10 9.5
Taxes, etc.	31,220.14	30,107.95	I. 11,061.19 54.8
Total	\$280,663.68	\$295,907.50	D. \$15,243.91 5.2
Net earnings	\$197,170.36	\$207,750.38	D. \$10,580.02 5.1
Gross earnings per mile	8,838.05	8,836.20	D. 453.21 5.1
Net earn. per mile	8,459.13	8,644.90	D. 185.77 5.1
Per cent. of working expenses	52.20	54.75	D. 2.55 4.7
Per cent. all expenses	58.74	58.75	D. 0.01

The income account was as follows:

Balance from previous year	\$311,831.80
Net earnings	197,170.36
Total	\$509,002.16
Dividends, 10 per cent.	200,000.00
Balance at close of year	\$309,002.16

The report says: "During the last previous fiscal year all the bonded or funded debt of the company was retired. During the fiscal year just ended all the floating debt has been extinguished."

"Although the gross earnings are considerably less than those of the previous year, we have been able to operate the road so that the net business earnings are not materially reduced. This we have been enabled to do by reason of the completion of the laying of steel rails on the whole length of the road and the more permanent character of the roadway."

"Our transportation or regular business profits have been sufficient to meet our usual dividends and taxes. Our general profit and loss account has, however, been slightly reduced by losses realized and charged up on account of accounts which have been closed up during the year." *

"The mileage of trains has been increased, as well as the gross tonnage of the road. The decrease in gross earnings is not in consequence of diminished business, but results from reduced compensation rates for business done, to meet the increased competition."

Boston & Providence.

This company owns a line from Boston to Providence, 44 miles, all double track, with 19.75 miles of short branches, and it leases the Attleboro Branch, 4 miles, making 67.75 miles worked. Its 43rd annual report covers the year ending Sept. 30, 1878. The branches owned have been increased by 1.21 miles.

The equipment consists of 45 engines; 108 passenger and

18 baggage and mail cars, and 681 freight cars. The company also owns a proportional share of the cars running on the Shore Line between New York and Boston.

The general account is as follows:

Stock (\$62,745 per mile)	\$4,000,000.00
Bonds (\$7,843 per mile)	500,000.00
Notes payable (\$7,843 per mile)	500,000.00
Accounts and balances	57,342.73
November dividend	120,000.00
Profit and loss	363,127.39
Total	\$5,540,470.12
Construction, etc. (\$77,058 per mile)	\$4,912,469.89
Stocks owned	346,569.42
Cash, materials, balances due	281,430.81
Total	\$5,540,470.12

The traffic for the year was as follows:

1877-78	1876-77	Inc. or Dec.	P. c.
Train mileage	800,010	803,007	D. 3,057 0.4
Passenger mileage	3,213,189	3,197,000	L. 15,580 0.5
Tons freight carried	37,557,491	35,965,043	D. 1,592,448 4.3
Tonnage mileage	16,561,460	19,155,837	D. 2,504,377 13.5

The earnings for the year were as follows:

1877-78	1876-77	Inc. or Dec.	P. c.
Passengers	\$724,505.86	\$800,356.25	D. \$75,850.39 0.5
Freight	417,302.20	500,206.73	D. 81,904.53 18.0
Express and mails	43,232.14	43,001.04	I. 231.10 0.5
Rents	21,377.01	20,797.58	I. 579.43 2.8
Total	\$1,206,417.21	\$1,373,361.00	D. \$166,944.39 12.2
Expenses	847,927.3	1,024,376.82	D. 176,449.29 17.2
Net earn.	\$358,489.08	\$348,984.78	I. \$50,504.90 2.7

Gross earn. per mile..... 17,806.90 20,639.64 D. 2,832.74 13.8

Net earn. per mile..... 5,201.36 5,244.74 I. 46.62 0.9

Per cent. of expenses..... 70.29 74.50 D. 4.30 5.8

Expenses include taxes, insurance and rent of Attleboro Branch, that rental amounting to \$10,956.24 last year. The income account was as follows:

Net earnings.....	\$358,489.08
Interest account.....	65,130.80
Net surplus	\$293,358.88
Balance from previous year.....	303,763.29
Total	\$607,122.17

Two dividends, each 3 per cent. \$840,000.00

Improvement account, balance charged off 83,904.78

\$323,904.78

Balance to next year..... \$363,127.39

The balance of improvement account has been charged to profit and loss, and all expenditures are now charged to current expenses. A dividend of \$5,740 was received on Union Freight Railway stock, and credited to interest account.

During the year a bridge of 60 feet span over Ten Mile River, in Attleborough, has been replaced by a brick arch, and a new iron bridge over the Neponset River, on the Canton meadows, has been pushed toward completion. An iron parapet has been placed on the Canton viaduct. There are now in the main road 80½ miles, and in the various branches five miles of steel rails. Six miles have been relaid with steel during the year, and the road-bed has been kept in the most thorough repair. The company have paid for, and charged expenses its proportion of two postal cars built by the New York & New Haven Railroad Company. One new passenger car and one new locomotive, to take the place of a car and locomotive broken up, have also been charged to expense account.

The report says: "The falling-off in receipts noticed for the past five years has been larger in comparison than ever before; meanwhile the decrease in expenses has equaled the expectations of your directors, and has more than kept pace with the diminished gross returns, showing, in part, that the road is reaping the benefit of the permanent improvements of the last ten years. With the uncertainties of the future, and the continued and increased rivalry of other lines, it has been considered judicious and prudent not to divide the entire revenue of the year, but to devote the surplus over 6 per cent. on the capital stock to the reduction of your debt. The interest-paying debt is now one million of dollars, divided equally between bonds due in 1893, and notes payable, and has been brought within the limit originally contemplated by the vote of the stockholders at a special meeting held March 4, 1873. The road has no floating debt." *

"No negotiations are in progress between this and any other company for the joint use and occupation of your passenger station, as has been currently reported. This rumor was doubtless due to the fact that last spring your President stated to the government of the Boston & Albany road, that whenever they had any thought of making a change in their passenger terminus in Boston (of which change it is apprehended there is no present intention), the Boston & Providence station offered ample accommodations for the offices of both corporations, and for the convenience of travelers over each road. It was also stated that a careful survey by the engineers of the two roads would readily show at the proper time whether there was space enough in the train-house and on the territory between it and the point of junction at Dartmouth street for the safe and convenient movement of trains. The suggestion was courteously received."

RAILROAD EARNINGS IN OCTOBER.

NAME OF ROAD.	MILEAGE.						EARNINGS.				EARNINGS PER MILE.	
	1878.	1877.	Inc.	Dec.	Per c.	1878.	1877.	Increase.	Decrease.	Per c.	1878.	1877.
Atchison, Topeka & Santa Fe.	869	741	128		17.3	\$445,000	\$342,822	\$102,178		29.9	\$512	\$463
Burlington, Ced. Rapids & North.	434	424	10		2.4	141,619	171,533		\$29,914	17.4	326	405
Cairo & St. Louis.	146	146				21,609	24,096		2,487	10.3	148	165
Central Pacific.	2,067	2,067	30		1.5	1,834,000	1,806,382	27,618		1.5	875	874
Chicago & Alton.	678	678				480,869	445,597	35,272		7.9	709	657
Chicago & Eastern Illinois.	159	159				82,006	82,498	108		0.1	520	519
Chicago, Milwaukee & St. Paul.	1,714	1,412	302		21.4	823,000	1,183,134		360,134	30.4	480	638
Chi. & N. Western.	2,078	2,037	41		2.1	1,508,858	1,508,776	31,918		2.0	754	785
Cleveland, Mt. Vernon & Del.	157	157				38,161	37,506	655		1.7	243	239
Denver & Rio Grande.	334	300	34		11.3	122,863	76,434	46,429		60.8	368	255
Houston & Texas Central.	516	506	10		2.0	426,832	361,649	65,183		18.0	827	715
Illinois Central, Illinois Lines.	819	819				400,130	612,185		122,055	10.9	508	747
" Iowa lines.	402	402				142,106	204,290		62,154	30.4	353	508
Indianapolis, Ill'm'gton & Western.	343	343				113,735	110,063		5,328	4.5	332	347
International & Great Northern.	519	516				220,607	181,236	39,371		21.7	428	351
Kansas Pacific.	673	673				448,514	395,361	53,153		13.4	660	587
Memphis, Paducah & Northern.	115	115				9,476	17,306		7,830	45.3	82	150
Missouri, Kansas & Texas.	786	786				349,896	329,531	20,365		6.2	445	419
Nashville, Chatta. & St. Louis.	349	349				137,104	172,353		35,249	20.5	393	404
Paducah & Elizabethtown.	185	185				30,457	34,150		3,663	10.8	165	185
Philadelphia & Reading.	800	800				1,408,674	1,527,774		119,100	7.8		



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EDITORIAL ANNOUNCEMENTS.

Passes.—All persons connected with this paper are forbidden to ask for passes under any circumstances, and we will be thankful to have any act of the kind reported to this office.

Addresses.—Business letters should be addressed and drafts made payable to THE RAILROAD GAZETTE. Communications for the attention of the Editors should be addressed to the EDITOR RAILROAD GAZETTE.

Advertisements.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. We give in our editorial columns our own opinions, and those only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.

Contributions.—Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies, the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and in their management, particulars as to the business of railroads, and suggestions as to its improvement. Discussions of subjects pertaining to ALL DEPARTMENTS of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.

CONSTRUCTING COMPETING BRANCHES.

The recent change in the control and in the presidency of the Wabash Railway Company has been accompanied by reports as to the purposes of the new management in constructing a Chicago connection which, in connection with certain other new projects for branches of railroads in the Northwest, gives rise to a fear that some of the lessons of the period since 1873 which seemed plainest, and were certainly costliest, have not even yet been well learned.

Before 1873 the railroad companies very generally seemed to consider all branches and extensions equally desirable which brought an equal amount of traffic, and all new railroad whatsoever as a desirable acquisition. Too little account was taken of the different values of traffic on different lines, and apparently none at all of the effect of multiplying lines in dividing traffic and reducing rates. Here is Kansas City, through which passes a traffic to and from Chicago yielding six millions gross and two millions net a year. We will extend our line to Kansas City and get half the traffic, and so make a million a year out of it. But when the extension is made, it appears, in the first place, that two roads cannot carry a given traffic so cheaply as one road can—a very elementary truth, which has been made evident in the history of every road, but which seems neglected when constructing lines for traffic for which there will be competition. Next it is found that the Kansas City traffic, which used to yield perhaps four cents per passenger per mile and three cents per ton per mile, now is taken for three cents per mile for passengers and two cents for freight. A profit may remain, but it is likely to be so small that it would never have tempted the company to construct a long line to secure it; and

if the results are satisfactory, or anything but disastrous, it is probably because the new line has local traffic enough to support it, or nearly enough, or because there has been an enormous growth in the through traffic. Scores of railroads, east as well as west, were constructed for the purpose of getting a share of a traffic which was already sufficiently accommodated, but which, under existing circumstances, was or was supposed to be giving a generous support to the lines which carried it. Some companies have doubtless been made actually poorer by the addition of such lines, though it would not be easy to prove it, because it cannot be proved how much higher their average rates would be if they had not begun a competition, nor that their rivals would not have built their competing lines at all events.

Scarcely anything except war is more wasteful than the efforts of two companies with good credit to occupy the same territory. Sometimes the result is the construction of a net-work of what are substantially duplicate lines—some distance apart, perhaps, and sometimes not connecting exactly the same places, but still doing substantially the same work, affording an outlet for the productions and an inlet for the supplies of the same territory. Scores of millions of dollars have been wasted in this way, and often worse than wasted; for the transportation system of the country would often be absolutely more effective without than with the superfluous lines. The public can not be made to see this, and it is true that often it profits by the multiplication of lines; but when this is the case it is always at the expense of the capital invested in the railroads—that is, one part of the community gains something, and another part loses more. If we have one railroad between New York and Pittsburgh carrying all the traffic between those two places which can easily reach it, it will be able to conduct the work in the most economical way possible. Suppose another company constructs a second road directly alongside: then the traffic certainly will be divided; the old road, having less traffic than before, will not be able to carry at so small an expense per unit of traffic; but by the competition of the new line it may be forced to reduce its charges to the public until the slightest possible margin is left above the increased cost of transportation. In this case the reductions in charges will be in spite of an increase in the actual cost, and at the expense of the partial or total sacrifice of income on the investment in both roads. If, however, there is a reduction, the public is likely to look upon the new road, by which, aside from the investment of capital, the cost of transportation has been absolutely increased, as a good thing. But if we take the community as a whole, it is undoubtedly a bad thing, in the first place a waste of the capital of the community in its construction, and in the next place a further waste by its operation, so much so that if the two railroads were public property it would be most economical to cease to work one of them, just as it would be better to close one of two highways running side by side, each with sufficient capacity for the whole traffic.

This view of the matter is rarely taken, because scarcely ever are two railroads alongside for more than a few miles, or even near enough to compete with each other throughout their whole extent. In such cases, however, the need of the new road must be measured by the extent and value of the traffic of the places which cannot reach the old one economically, or by the saving on the traffic which can reach the new one more easily than the old one.

But this is not the place to develop a general theory for the distribution of railroads exactly in accordance with the needs of the country. By the practice of our country, railroads will be built wherever they will pay, and just as much where they make their profits by taking them from pre-existing roads as where they do a work previously not done at all. What we aim at here is to show that the traffic taken away from another railroad is not likely to be nearly so profitable as that developed or taken from the common roads, and that extensions built to secure traffic of the first kind may very easily fail to make any sufficient return on the capital invested.

In this case it is probably desirable that the Wabash should have a Chicago outlet by which it may always be able to carry freight to and from its Illinois lines. It is better for it to carry everything to and from Toledo if it can; but the country on its lines in Illinois has intimate relations with Chicago, and will quite generally insist on buying its supplies there, and when lake rates are very low and rail rates high enough to pay expenses it will often insist on sending grain there, quite generally on sending hogs and cattle there. If the Wabash cannot carry this business to and from Toledo, it is, of course, better for it to carry it as far as it can on the way to and from Chicago, otherwise it

will go over other roads, and the Wabash will not make anything whatever out of it. It is, however, decidedly to its disadvantage to have the traffic go to Chicago instead of Toledo. As the roads now are, it loses at least 250 miles of haul by such a turn, even if it carries the business as far as possible on its own road. And if it had a road of its own to Chicago, it would still gain more from Toledo than from Chicago traffic, as the distance to Chicago would be at least 120 miles less than to Toledo.

Chicago and St. Louis are the two greatest and most rapidly-growing cities of the West, standing somewhat in the relation to each other that New York and Philadelphia bear in the East. The traffic between them, however, is by no means so important as might be supposed from their individual importance, for this reason, that they are engaged in much the same kind of work, collecting and forwarding to the East Western products, and distributing in the West Eastern manufactures. Neither gets any considerable portion of its supplies from the other. St. Louis happens to lie in the path from Chicago to the Southwest, and Chicago is on one of the routes between St. Louis and the East, and hence part of the passengers and merchandise bound to one of these places passes through the other. But the traffic seems not to have been greatly valued, for long after various routes had been completed between the two cities, they remained substantially unutilized, leaving the whole traffic to the Chicago & Alton. It was not till the Vandalia Line was completed, we believe, that trains were run through between the two cities by any other line. But the Illinois Central before that would have made a short line in connection with either the Indianapolis & St. Louis or the Ohio & Mississippi. Now, since it has acquired the Gilman & Springfield line and the Decatur & St. Louis line of the Wabash has been built, there are no less than eight lines between Chicago and St. Louis, varying from 281 to 317 miles in length, that can be made by a combination of the Illinois Central with some other road, and there are at least two other north-and-south roads that can be used in connection with nearly all the roads extending eastward from St. Louis to form Chicago-St. Louis lines. Each north-and-south road would probably work a St. Louis line if it seemed worth the while to the several roads concerned.

The utilization of such combinations cannot reasonably be objected to, wherever traffic enough can be had, through and local, to support the through trains; but it is painful to see good money put into a new road laid across the already too crowded meshes of the Illinois net-work simply to make a new line for through traffic. It has been reported that while the Wabash would construct a new line into Chicago the Illinois Central would build one into St. Louis. Probably neither company has finally resolved to make such new lines, and the talk may be rather of possibilities suggested than of policies decided upon. Both companies might make themselves "independent," perhaps, by the expenditure of a million or two dollars each; but it is quite possible, even probable, that the Illinois Central with an extension from Decatur to St. Louis, and the Wabash with a branch from Tolono or Beemer to Chicago would be worth less than without such additions. The traffic would be more divided than at present, and the through trains would not be so well filled and consequently would return less profit, and it is quite possible that there would be a further loss by a reduction of rates in consequence of the greater competition. It is simply impossible to work two lines as cheaply as one; and one can do several times as much work as now exists for it. It is of course possible that one company asks unreasonable terms of the other; but it is certain that terms could be made which would make it more profitable for both to use the roads already constructed than to build new ones.

But, regrettable as would be a competition of this kind between these two companies, it is less to be feared than among the roads further north. A great part of the traffic of Central Illinois is already pretty thoroughly spoiled. The roads there for some years have had to accept the trunk-line rates per ton per mile on a very large part of their local and all or nearly all their through freight—a necessity which is deadly to a road with a thin traffic. North of Joliet, Peoria and Quincy the roads have not yet had to submit to this necessity, and it is of the utmost importance to them to continue to avoid it, at least until the bulk of their traffic is something like that of the trunk lines. It is altogether unjust that the Chicago & Northwestern, for instance, should have to accept the same rate per ton per mile as the New York Central or the Pennsylvania, with five times as much traffic. The road with thin traffic requires a higher rate of profit in

order to pay interest on its capital and a greater amount to meet its working expenses. On most Western roads the expense per ton per mile is greater than the receipt on the trunk lines and their immediate connections. But we need not compare them with the trunk lines in order to see how they would suffer if Omaha and St. Paul, Rock Island, Dubuque and Madison were included among the places to which trunk-line rates are made. What they have to fear is the fate that has already befallen the east-and-west roads that cross Illinois south of Chicago, most of which are in receivers' hands, and none of which pay dividends. These roads have not been unfortunate for want of traffic. The Vandalia Line has a heavier, and the Wabash a much heavier traffic than the Chicago, Rock Island & Pacific. But all the cross roads have to accept very low rates on most of their traffic; on a good deal of it, probably, rates which of late years have been less than cost. Let us compare the average receipt per ton per mile by the last reports:

Chicago Roads.		Roads South of Chicago.	
Chicago & Alton	1.45 cents.	Wabash	0.83 cent.
Chicago, Rock Island & Pacific	1.56	Ind. & St. Louis	1.06 cents.
Chicago & North-western	1.72	Vandalia Line	1.27
Illinois Central	1.82	Ohio & Mississippi	1.41
Chic. Mil. & St. Paul	2.08	Ind. Bloom. & West	1.44

* Year ending with June, 1876.

Now, suppose the Rock Island compelled to accept the Indianapolis & St. Louis rate; its profits in 1877 would have been reduced by about \$1,350,000, equal to nearly 5½ per cent. on its stock. And all the dividend-paying roads north of the Chicago & Alton would suffer similarly—some of them much more. It is, therefore, of the utmost importance to them to avoid complications which will make their western stations pro-rating points. They prosper now because they can maintain rates which pay a fair margin over working expenses. Rivalry and the extension of branches to tap the traffic centres of neighboring systems may result in the introduction of some line which will pro-rate with the trunk lines to points west of the Mississippi and north of Burlington and Peoria, which would be almost a sentence of death to several great and now prosperous railroad companies.

The Change in the Wabash Presidency.

The change in the management of the Wabash Railway will attract a good deal of attention, for though that road has never been of much advantage to its owners, it carries a great deal of traffic, and is one of the most active competitors for business in an immense tract of country, and affects the interests, directly or indirectly, of nearly every railroad in Illinois and Indiana, and of a great many elsewhere. It is peculiarly situated, being a southwest and northeast line, about parallel to the Atlantic & Great Western and the Cleveland, Columbus, Cincinnati & Indianapolis, but intended particularly to carry traffic to Toledo that otherwise would be likely to go either directly east by rail, or to Lake Michigan and thence by lake. But when it was constructed it was expected that the produce that it brought to Toledo would nearly all go forward by lake and canal; and the advantage it had over the roads to Chicago was the great saving in the length of the lake voyage which it effected by a comparatively short journey by rail. For instance, at Danville, Ill., it is 250 miles by the Wabash to Toledo and 182 miles by rail to Chicago; but by the additional haul of 118 miles the long circuit of some 700 miles is saved of the voyage from Chicago to Lake Erie. This was a matter of importance when the lake rates from Chicago to Buffalo were ten or fifteen cents a bushel, as they not infrequently were before 1873, but when they are a cent and a half, as they have been this year and last at times, it does not count for much, there being then very little difference between the Chicago and the Toledo lake rates. But whether the Wabash makes anything or not, it usually gets a large share of the traffic of the country through which it runs, and of the cities at its termini and the railroads beyond. With termini on the Mississippi at St. Louis, Hannibal and Quincy, and a line worked in connection with it to Keokuk and Burlington, it stands prepared to take a share of the traffic of pretty much all the railroads west of the Mississippi below Rock Island.

The purchase of a controlling interest in the road by Mr. C. K. Garrison, the President of the Missouri Pacific, is accompanied by a report that the company will now purchase or form a combination with the Chicago & Paducah Railroad, one of the least productive of the newer Illinois railroads, and one of the latest of any length to be completed. This road extends nearly due north and south, beginning at Streator, the terminus of the Fox River Branch of the Chicago, Burlington & Quincy Railroad, 100 miles southwest of Chicago, and extending thence southward

156 miles to the Springfield Division of the Ohio & Mississippi at Altamont, 75 miles southeast of Springfield. There is scarcely any line to be found which has more junctions; there are ten between Streator and Altamont. Moreover, the northern part of the road is near another north-and-south line, the Chicago & Alton, and the rest of it not far distant from another, the Chicago Branch of the Illinois Central. There are but one or two tolerable towns on it from one end to the other. At its northern terminus there are important coal mines, but their product goes northward chiefly, not southward, where there are other mines.

The earnings, expenses and net earnings of the Chicago & Paducah Railroad have been reported as follows to the Illinois Railroad Commissioners since its completion in 1874, the years ending with June:

	Gross earnings.	Working expenses.	Net earnings.
1873-74	\$190,808	\$101,654	\$89,154
1874-75	362,530	124,924	237,426
1875-76	379,422	185,337	194,085
1876-77	271,370	187,382	83,988

Total \$1,203,930 \$590,297 \$604,653

The returns for the last year have not yet been published, but for the other four years the average earnings have been about \$300,000 gross and \$151,000 net per year, which is less than \$2,000 gross and \$1,000 net per mile. The same authority gives the funded debt as consisting of \$2,961,000 7 per cent. bonds, on most of which we believe that no interest has ever been paid. The annual interest on this debt is \$207,270, or about one-third more than the average net earnings. For the last year reported the net earnings were at the rate of less than 3 per cent. on this debt.

The object in securing this road is said to be to secure the Wabash an independent entrance into Chicago. But the northern terminus of the Chicago & Paducah is a hundred miles from Chicago, and to get there it is said that a new road will be built on the line of the Decatur & State Line (on which some grading was done about 1871) from Strawn, which is 41 miles southeast of Streator, northeastward to Chicago. This would be about half way between the Chicago & Alton and the Chicago Branch of the Illinois Central, and nearly parallel to them, and just about 100 miles long. Now the Chicago & Paducah crosses the Wabash at Bement, 53 miles south of Strawn, but 63 miles north of the southern terminus of the road. Out of the 156 miles of the Chicago & Paducah, therefore, only 53 would be used in the Chicago connection of the Wabash. The Illinois Central reaches the Wabash at Tolono by a line 187 miles long. To duplicate this would require but 37 miles more new road than to make a Chicago line out of the 156 miles of the Chicago & Paducah.

It has also been intimated that the new purchasers of the Wabash may have had in view the increase in value that might be given to that road by practically uniting it with the Missouri Pacific, which has been long under their control. The Missouri Pacific is one of the chief carriers of freight to St. Louis, and a great deal that it carries does not stop at St. Louis, but is consigned to points beyond. The Wabash now gets only part of the Missouri Pacific freight. It might be argued that it would be greatly benefitted were it to get the whole. But this is on the assumption that it would continue to get as much from the other roads as before its union with the Missouri Pacific, which it would not do. On the other hand, if the Wabash were identified with the Missouri Pacific that would be reason for the competitors of the latter roads to work against the Wabash just as against the Missouri Pacific. At present the business out of St. Louis is pooled, and the Wabash gets one-fifth of it. Doubtless it would not be allowed any greater proportion without a struggle, whatever might be the connections it might make with other roads. We see that when Mr. Vanderbilt obtained control of the Michigan Central, he found it advisable not to turn its traffic all over his own road, but to allow his rivals to take more than half of it.

The Wabash has been distinguished of late years for its eagerness to get traffic. It has succeeded very well, but apparently by sacrificing its profits. Of all the roads crossing Illinois south of Chicago it reports the lowest average freight-rate, for 1877 only 0.83 cent., while the Pennsylvania's even was 0.98 cent. and the Lake Shore's 0.84 cent. It would appear, then, that an addition of traffic will hardly be of any value to this company, unless it can in some way contrive to get higher rates. It is too much to expect of a road with no heavier traffic than its, that its working expenses per ton per mile should be less than, or even as low as, five-sixths of a cent. In 1877 an addition of one-fifth to its freight traffic would, we venture to say, have added the meagre trifle to its profits; but the addition of one-fifth to its average rates (which would still have left them lower than any other reported in Illinois) would have added 60 per cent. to its net earnings.

About a cent and a quarter per ton per mile is the best medicine for this company. It would do it more good than a thousand miles of new branches and connections with every city in the Northwest.

October Earnings.

October earnings are reported in our table for 29 railroads, with 17,877 miles of road, which is about 22 per cent. of the mileage now in operation in the United States. These 29 roads, with 3.2 per cent. more mileage than last year, earned in October 1.5 per cent. less, their average earnings per mile having fallen from \$724 to \$691, or 4.8 per cent. The comparison, however, is with one of the most favorable months of recent years. Of the 29 roads 15 show increases, both in total earnings and in earnings per mile of road, but there are few large increases on important roads. The most important per mile of road are 44.8 per cent. on the Denver & Rio Grande, 22 per cent. on the International & Great Northern, 15.7 on the Houston & Texas Central, 13.4 on the Kansas Pacific, 13 on the Iron Mountain, and 10.6 on the Atchison, Topeka & Santa Fe. Larger than any of these is an increase of 116.2 per cent. on the Scioto Valley, but this is because the road had hardly begun to do any business last year; its earnings this year are among the lightest reported. (Only Cairo & St. Louis, Cleveland, Mount Vernon & Delaware, Memphis, Paducah & Northern and Paducah & Elizabethtown are lighter.)

Comparing the results with those of previous years, we have the following earnings per mile of road:

	1878.	1877.	1876.	1875.	1874.
Atch., Top. & S. F.	\$512	\$483	\$401	\$370	\$283
Burl. C. R. & Nor.	326	105	303	339	355
Cairo & St. L.	148	105	209	204	...
Cen. Pac.	875	874	1,157	1,229	1,163
Chic. & Al.	709	657	820	732	848
Chic. Mil. & St. P.	480	838	584	606	616
Cleve. Mt. V. & Del.	724	785	935	938	937
Denver & R. G.	243	239	223	...	...
Ill. Cen. Ill.	508	747	744	859	...
Ill. Cen. In.	333	508	...	...	...
Ind. Bloom. & West.	332	347	404	400	427
Int. & Gt. Nor.	428	351	305	340	322
Kan. Pac.	606	587	513	469	471
Mem., Pad. & Nor.	82	150	148	172	...
Mo. Kan. & Tex.	445	419	427	388	399
Nash. Chat. & St. L.	393	404	421	457	...
Phila. & Erie	1,225	1,365	1,171	1,167	...
St. L. A. & T. H., Belleville	785	877	718	808	927
St. L. I. Mt. & S.	843	740	639	587	592
St. L. K. C. & N.	655	657	620	522	552
St. L. & S. E.	344	323	317	300	378
Tel. P. & Warsaw	441	480	582	537	...
Union Pacific	1,210	1,130	1,284	1,221	1,100
Wabash	752	687	700	...	...

Of 25 roads that report for the past three years, twelve had larger earnings in October this year than last, and 14 larger this year than in 1876, when freight business was generally bad, but Centennial passenger business at its height (not much affecting most of the roads that report, though).

Twelve out of 21 roads report smaller earnings this year than in 1875, six out of 15 smaller than in 1874. The increase in the value of the currency makes a great difference in the actual value of the earnings from year to year. In October, 1874, a hundred dollars in currency was worth about \$91 in gold; in 1875, only \$86.25; in 1876, \$91 again; in 1877, about \$97; and last October as much as \$99.75. Reducing to gold values therefore, and comparing with the currency values, the earnings of the Missouri, Kansas & Texas, for instance, have been:

	1878.	1877.	1876.	1875.	1874.
Currency	\$445	\$419	\$427	\$388	\$363
Gold	444	406	389	335	...

That is, instead of an increase of 14½ per cent. from 1875 to 1878, as would appear from a comparison of the currency earnings, by the more stable gold earnings the increase has been 22½ per cent. This great change in the value of the currency deserves to be taken into consideration in all comparisons of this kind. The dollar is a good deal bigger than it used to be. It is so to the employé and the manufacturer of material and supplies, and it should be so considered by the stock and bondholder.

For the ten months ending with October we have reports from 27 railroads with 18,050 miles of road—also about 22 per cent. of the mileage now in operation. These roads, working 3.3 per cent. more road than last year, have in the ten months earned 3.7 per cent. more, the earnings per mile having increased from \$5,675 to \$5,693, or 0.3 per cent. Eleven of the 27 show decreases in total earnings, and thirteen of them decreases in earnings per mile. There are six increases of more than 10 per cent. in earnings per mile, but only one decrease in that proportion. The Northwestern roads that are now suffering from a light wheat crop still show for the whole year larger earnings than last year, the great increases in the first six or seven months not yet being balanced by the great decreases in the last three or four months. With the exception of the Canada roads and the Reading no road east of Cleveland reports, and considerably more than half of the 18,050 miles reporting is west of the Mississippi.

Record of New Railroad Construction.

This number of the *Railroad Gazette* contains information of the laying of track on new railroads as follows:

Spencer.—Completed from Spencer Station, Mass., north by east to Spencer, 2 miles.

Dannemora.—Completed from Plattsburg, N. Y., west to Clinton Prison, 17 miles. It is of 3 ft gauge.

Lockport & Buffalo.—The first track is laid, from Tonawanda, N. Y., northeast 8 miles.

Pittsburgh & Lake Erie.—Extended from Middletown, Pa., east by south 8 miles to a point two miles from the Pittsburgh terminus.

Altoona Coal & Iron Co..—This company's road is completed from Martin's, Pulaski County, Va., to the Altoona coal mines, 8½ miles. It is of 3 ft. gauge.

Elberton Air Line.—Extended from Royston, Ga., east by south 10 miles. It is of 3 ft. gauge.

Alabama Central.—Extended from York, Ala., westward to Lauderdale, Miss., 15 miles. It is of 5 ft. gauge.

Chatfield.—Completed from Elyria, Minn., southward to Chatfield, 12 miles.

Sioux City & Pembina.—Extended from Calliope, Ia., northward, to Eden, 5 miles.

Chicago, Burlington & Quincy.—Track is laid on a new branch from Creston, Ia., northwest to Fontanelle, 22 miles.

This is a total of 107½ miles of new railroad, making 1,947 miles completed in the United States in 1878, against 1,945 miles reported for the corresponding period in 1877, 2,102 in 1876, 1,150 in 1875, 1,686 in 1874, 3,355 in 1873 and 6,311 in 1872.

THE EAST-BOUND APPORTIONMENT is still imperfect, but the places which have agreed on a division heretofore are in working order, and the important place, Cincinnati, has effected a division within a week and appointed a commissioner, intending to begin operations Dec. 1. Mr. Guilford has been at work to see what can be done about pooling the smaller points added at the New York meeting, and there have been negotiations about making a division at Chicago instead of waiting and having a division hereafter on the results meanwhile. It has been reported at Chicago that such a division had been "virtually arrived at." This is too sanguine a statement. We find on inquiry that so far the negotiations have consisted in the submission of a certain proposition to the several managers by a disinterested party, and its acceptance by all *except one*. One is enough, however, to defeat any arrangement of this kind, and if the objector had positively and finally refused to accept the proposition, there would be no hope of a division at this time, any more than there was at the New York meeting, the objections now coming from the same party that objected then. But we understand that there was not a positive refusal, and that negotiations are still in progress which may indeed result in an agreement before this paper can appear. We believe that the proposition under consideration is to accept the same divisions as those agreed upon last spring, namely, 32 per cent. to the Michigan Central, 27 to the Lake Shore, 24 to the Pittsburgh, Fort Wayne & Chicago, 10 to the Baltimore & Ohio and 7 to the Pittsburgh, Cincinnati & St. Louis. Each party says that this gives him a very inadequate share of the business, but those who accepted it most readily last spring object to it most now.

THE WINTER EAST-BOUND FREIGHT RATES, which went into effect Nov. 25, are the lowest that ever have been made for the winter, and five cents lower on the great staples, grain and meats, than those made for the last six weeks of open navigation last year, and the same as those for the six weeks from the first of September to the middle of October that year. Nevertheless there seems to be a good deal of doubt whether these low rates can be maintained this winter. They probably can be on meats, and it is very doubtful whether it is worth while to carry the grain at any lower rate in the winter. If it cannot bear that, it will perhaps be better for all parties that it should remain stored until spring and then come forward by water. The railroads have too often paid for the privilege of having a grain traffic—and that is a luxury which they cannot well afford. If there will be a profit on it at 30 cents, however, and it will not move at 35, it will not take long to find it out, and to change the tariff to suit. It must be remembered that the roads have not had a great deal of grain this fall at the 30-cent rate, and they can do without hereafter as well as they have heretofore.

LAKE RATES have advanced steadily throughout the week, during which vessels were starting down on their last trips with the prospect, at its close, of not getting through until after their insurance expires—on the 1st of December. Beginning Thursday of last week at 4 cents a bushel for corn from Chicago to Buffalo, the rates rose from 5½ to 6 cents on Tuesday of this week, and from Milwaukee, 7 cents for wheat. Very few more shipments are likely to be made.

Canal shipments from Buffalo to New York ceased last Saturday. Clearances this week are for interior points, there not being time for the boats to get through. The Canal Superintendent has given notice that the canals will be closed Dec. 7, unless frozen up sooner. There was little change in rates in the four days since we noted them last week, remaining very low to the last—about 6 cents for wheat, 5½ for corn and 3½ for oats. Rail rates from Buffalo remain unchanged at 8 cents per bushel for wheat, 7½ cents for corn and 5 for oats.

Ocean rates are substantially unchanged.

A REGISTER OF FREE PASSES is proposed on the Old Colony Railroad, open to the inspection of all stockholders. In

many respects this would seem to be a good thing, leading some to be shy of asking for passes and inclining the officers to be cautious in granting them. Railroad officers often are submitted to a tremendous pressure in this matter, which would doubtless be lessened somewhat if the applicants knew that the stockholders would see all the names and be able to ask explanations. This, it is true, is a mere palliative, if it is that, in a case which demands amputation; but some of the more scandalous cases might be prevented in the interest of the community if the judges, legislators, leading editors and the like who ask for passes, or have them sent them without asking, knew that their neighbors and the community generally might find out all about it.

THE BOSTON & MAINE RAILROAD COMPANY shows a record as to dividends which cannot be equaled in this country, except possibly by the Boston & Worcester and its successor, the Boston & Albany. The first dividend paid by the Boston & Maine was declared in October, 1838, and of the forty years since then not one has passed without a dividend. Each share of the original stock has received in those forty years \$299.50, being an average of very nearly 7½ percent. a year; and in addition to this, all taxes on the stock have been paid by the company for many years past.

THE REVISED RULES FOR THE REPAIRS OF FOREIGN CARS will be the subject for discussion at the December meeting, at the rooms of the Master Car-Builders' Association, No. 113 Liberty street, New York, to be held Thursday evening the 19th. All railroad men and "others" are invited to attend.

EDITORIAL LETTERS.

V.
CHICAGO.

The relative merits of ten-wheeled or Mogul and ordinary eight-wheeled engines for freight service is at present attracting a good deal of attention among railroad men in Chicago, and diametrically opposite opinions are held by different officials in relation thereto. One of these stated his view of the case by remarking that there was no reason why the addition of another pair of driving-wheels should cause an engine to pull a heavier train, and that as a matter of fact, the Mogul engines on his line would take very few if any more cars than the heavy eight-wheeled locomotives, with 17 x 24 in. cylinders, and therefore he did not want any more Moguls. Another official who is also using Moguls took quite a different view. The engines of that plan on his road, he said, took 50 per cent. more cars than the American class, and the former he believed to be the most economical for freight traffic. A little investigation showed that the first man was using a very heavy pattern of American engine and light Moguls, whereas the latter used heavy moguls and somewhat light American engines, which would perhaps account for the difference in the results attained, but not for the conclusions drawn therefrom. The truth would seem to be that an American locomotive with four driving-wheels and the greatest permissible amount of weight, say 12,000 lbs. on each wheel, will pull a certain load corresponding to the adhesion due to that weight and to the cylinder and boiler capacity, all of which, it is assumed, are properly proportioned to each other. If then it is required to construct an engine with greater capacity, one or more additional pairs of driving-wheels must be added, unless the permissible load on each is exceeded. If one more pair is added and all the wheels are loaded with the maximum weight of 12,000 lbs. each, there will then be 72,000 lbs. of adhesive weight on the six driving wheels, instead of 48,000 on four. If the cylinders and boiler are made proportional they must be increased 50 per cent. in size and capacity. Such an engine, whether of the Mogul or ten-wheeled pattern, should, and will, pull 50 per cent. heavier trains than the eight-wheeled engine. If it does not, then there is something wrong. If, however, an eight-wheeled engine is made with 12,000 lbs. weight on each driving-wheel, and one of the ten-wheeled or Mogul plan is made with a weight of 8,000 lbs. per wheel, the other parts being properly proportioned, there is no reason why the one machine should pull more than the other. This is the very A B C of locomotive building, which, somehow, seems to have been confused with the quite different question of the relative economy of hauling big trains in comparison with little ones. With reference to this, it is hard to understand how there can be two opinions if the train expenses are compared. Thus, let us take the following:

Wages of locomotive runner per 100 miles run	\$4.15
" " fireman	2.10
" " conductor	3.25
" " two brakemen	2.50
	\$12.00

If now the average train-load is 24 cars, the expense for train wages, per car per mile, is ½ cent. Suppose, however, that with heavier and more powerful engines the train-load is increased 50 per cent., or to 36 cars, then the expense for train wages is ½ cent per car per mile, or a difference of ¼ of a cent. By the use of the heavier class of engines, therefore, a railroad company whose freight cars run 60,000,000 miles per year—and on some of the Chicago roads the cars make a greater mileage than this—would save \$100,000 from this source, on the supposition that the other train expenses are the same per car per mile in both cases. The consumption of fuel and oil by the engine, if reckoned per car per mile, would probably be less with the big engines than with the small ones. While the cost of repairs per train mile would be greater with the big engines than with the little ones, this expense per car per mile would be about the same in both cases, or perhaps less with the larger engines.

If "Consolidation" engines, with eight driving-wheels,

are used, instead of Mogul or ten-wheeled engines, then it will be possible to take a train of twice as many cars as the American engine will pull, with saving of ½ of a cent per car per mile, amounting to \$200,000 per year with a car mileage of 60 millions of miles.

It is of course said that heavy engines are more injurious to the track than light ones, and generally their introduction meets with opposition from the road department. If the weight per wheel is no greater in the one engine than in the other, it is not plain why there should be much difference in the wear to the track in proportion to the work which the two engines do.

On the Illinois Central road, Mr. Hayes says that 85 per cent. of business is local and that the larger engines are unsuited for doing the switching which must be done at the different stations. This objection, however, does not apply to the use of these engines for through traffic, and on some of the other Chicago roads the proportion of through to local traffic is very much larger than on the Illinois Central. Considering how great is the saving which can be effected by the use of larger engines their adoption on roads which have a heavy through traffic seems to be inevitable.

It is also worthy of note that on all the Chicago roads the practice of increasing the car-loads has become quite general. Instead of loading eight-wheeled cars with ten tons, as has been the practice, much heavier loads are now permitted.

To show what the actual practice is, the following weights of cars and the loads they carried were taken from the scale records of the Chicago, Burlington & Quincy road for one day. The loads are the heaviest noted during the one day.

Weight of Car.	Weight of Load.
20,500 lbs.	28,500 lbs.
19,600 "	29,400 "
20,000 "	30,000 "
20,700 "	28,800 "
21,400 "	29,100 "
20,300 "	29,700 "
20,850 "	28,700 "
20,500 "	29,600 "
19,500 "	29,000 "
20,650 "	28,400 "
19,800 "	28,200 "
20,700 "	28,800 "
22,500 "	20,000 "
21,050 "	28,500 "
21,100 "	29,000 "
20,400 "	29,100 "
20,000 "	29,000 "
21,400 "	29,000 "
20,900 "	28,600 "
20,800 "	30,200 "
19,200 "	28,200 "

On this road all box cars are rated at a capacity of 28,000 lbs. of load, and shippers are permitted to load 32,000 lbs. of grain. One of the agents of the company informed the writer that it was not an uncommon thing to have their cars come in loaded with 35,000 lbs. of grain. Flat cars weigh from 16,000 to 17,000 lbs., and are loaded with even greater loads than box cars. Eight-wheeled coal cars on this line weigh 17,500 lbs. and are rated at 32,000 lbs. of load. This increase of car-loads is not confined to the Chicago, Burlington & Quincy road, but the practice is followed on nearly all the other roads terminating at Chicago. On the Chicago & Alton line some four-wheeled coal cars have just been finished which weigh 10,650 lbs. and are intended to carry 28,000 lbs. If this thing goes on, the narrow-gauge advocates will be obliged to overhaul the laws of statics and dynamics, because, according to their theories, such loads cannot be carried if the rails are placed 4 ft. 8½ in. apart.

At the shops of the Chicago, Rock Island & Pacific Railroad there has been and still is a great deal of activity. In the car shops, Mr. Verbrück has just completed 300 freight cars, and the company has bought 200 more. He is just completing 12 new caboose cars, and will soon commence on 50 more flat cars and three new sleeping and six first class passenger cars. The sleeping cars are to be 60 ft. 5 in. long x 10 ft. 13½ in. wide over the bodies, and will have six-wheeled trucks.

In the locomotive department, Mr. Twombly has just completed the last of six Mogul engines, and he is about to begin on three new passenger locomotives. The Mogul engines have 18 x 24 in. cylinders; boilers, 50 in. in diameter at smoke-box; driving-wheels, 51 in. in diameter, and fire-box, 5½ ft. long inside. The distance from the centre of truck-wheels to centre of leading driving-wheels is 7 ft. 9 in.; from centre of leading to centre of main wheels, 7 ft., and from centre of main to centre of trailing-wheels, 8 ft.; making a total wheel-base of 22 ft. 9 in. The weight of the engines is about 80,000 lbs. The steam-ports are only 12 in. long, and the maximum travel of valve is 5 in. These, as will be seen from the dimensions, are very powerful engines, and Mr. Twombly reports that they will pull 50 per cent. more cars than the American engines in use on his road in freight service.

In connection with the shops of the Chicago, Rock Island & Pacific road, there is a large foundry which is leased to and operated by Mr. Bass, who makes all the castings for this company, and also does a general foundry business. At present an extension of the foundry is in progress. It is to be built entirely of iron, by the American Bridge Company. The old foundry is 194 feet long and the new extension is to be 234 x 60 ft. In the old portion there are two cupolas, and about 50 wheels and 14 tons of other castings are now made per day. The new portion will have two additional cupolas, and when completed there will be sufficient capacity to melt 80 tons of metal per day.

Our visit to the Chicago & Northwestern shops was too short to do them justice. Both the locomotive department and the car department are busy on repairs. Mr. Tilton, the Master Mechanic, expects to build some new engines next year. Mr. Campbell is at work on an order for 150 stock and three baggage cars, and has just completed three first-class

passenger cars. With the splendid business which the Northwestern road is now doing, and its prospects for next year, it is not probable that these shops will be wanting for work to do. In fact, the repair shops as well as the manufacturing establishments in the Chicago region seem likely to be well supplied with work during the coming year. While there are few evidences of the rush of inflated times, the requirements of business seem to be gradually increasing the demand for all kinds of railroad material and equipment. Although the approach of prosperity is very gratifying, there is another aspect of the condition of things among the railroads which is not so promising. At the present time there seems to be, we regret to say, a great lack of originality and ingenuity among those who have charge of the repair and construction of rolling stock and railroad machinery of most of the railroads. Of mere contrivance there is plenty. That is, if any obvious end is to be attained, the master mechanics and car-builders are not slow to propose appliances for accomplishing the desired results; but of original research there is hardly any worthy of the name. The same is true of invention, if by the latter is meant new and improved methods of construction, which involve the application of scientific principles or which are the result of any abstruse investigations and deductions. Even well known appliances, that is, those which have often been described in books and papers, are not used, because those in authority are ignorant of them. Such devices as the Allen valve, furnace door deflectors, screw reversing gear and the Walschaert valve gear, which are so much used in Europe, are almost unknown among master mechanics here, and are hardly used at all in this country. Even regarding such matters of prime importance as the form and proportions of the United States standard of screw threads, there are many men occupying responsible places who are ignorant. Many of them do not read enough to keep up with the current knowledge of their occupations, and the result is that they follow only in the path of their own experience and observation. An improvement, unless it be a patented invention, is very slow to be introduced. With the latter the patentee is an interested party to make its merits known, and to instruct others in relation thereto, and in that way it is likely to be brought into use. At present it seems as though we were in danger of falling into a state of stagnation, and that our rate of progress, if not arrested, is at least considerably retarded. It is of course true that with the ordinary duties of their positions, railroad officers have little time or opportunity for making experiments or investigations. When business is active they have plenty of other duties to look after; when it is dull, extra expenses of any kind are looked upon with disfavor. Then, too, investigations are often duplicated. One man in one part of the country will try the same things that another person has experimented with elsewhere. It is also true, no doubt, that the sort of practical ability which is required to manage the prosaic and multifarious details of a railroad is not the best qualification for conducting delicate experimental researches. That some work of the latter kind could be done with great profit to railroads there is no doubt. The difficulty seems to be in devising a plan for doing it which would secure the confidence and cooperation of railroad companies, and which could be carried out successfully. It was proposed a few years ago to establish a mechanical laboratory in connection with the Master Mechanics' Association. The subject was fully discussed, but was finally abandoned by those who were at first in favor of it, because it was seen that with an Association so loosely organized as the Master Mechanics' Association is, it would be impracticable to manage such a scheme. It was afterward suggested that a committee on "experimental research" be appointed, and that it employ some one to make certain specific investigations or experiments under the supervision of the committee. The members of the latter, it was seen, would have no money to expend, and no power to appropriate any, so that their operations would be dependent on voluntary contributions. The suggestion did not meet with favor, and was never acted on. The only experimental investigations which have thus far been carried on by railroad companies in a co-operative way have been those relating to patent legislation under the direction of the Eastern and Western Railroad Associations. If it is practicable to carry on experiments for this purpose, it would seem as though the difficulties of doing it in order to increase our knowledge would not be insurmountable. An organization something like what would result from a union of the Eastern and Western Railroad Associations, with a department devoted to experimental research, would be able more effectively to do the work which they are now doing, and the added department could then devote some time to investigations purely for the purpose of increasing our knowledge. The expenditure for such work, if it was properly done, would be the most profitable investment of money railroad companies could make.

General Railroad News.

MEETINGS AND ANNOUNCEMENTS.

Meetings.

Meetings will be held as follows:

Richmond, Fredericksburg & Potomac. adjourned annual meeting, at the office in Richmond, Va., Jan. 21, 1879.

New York & New England. annual meeting, at the company's office, No. 224 Federal street, Boston, Dec. 8, at 11 a.m.

Pittsburgh & Connellsville. annual meeting, at the office in Pittsburgh, Pa., Dec. 2, at noon.

Boston & Maine. annual meeting, in the City Hall at Lawrence, Mass., Dec. 11, at 10 a.m.

Keokuk & Des Moines. special meeting to authorize increase of capital stock, in Des Moines, Ia., Dec. 28, at noon.

Dividends.

Dividends have been declared as follows:

Burlington & Missouri River in Nebraska, an extra dividend of $2\frac{1}{4}$ per cent. from the net income of the unpledged portion of the land grant, payable Dec. 16.

Connecticut River. 4 per cent., semi-annual, payable Jan. 1.

Western Association of General Passenger and Ticket Agents.

In accordance with the resolutions of the General Passenger & Ticket Agents' Association recommending the formation of district associations, the Western Association was organized at a meeting held in Kansas City, Mo., Nov. 19. There was a full attendance. Mr. A. C. Dawes, of the Kansas City, St. Joseph & Council Bluffs, was Chairman, and E. A. Ford, of the St. Louis, Iron Mountain & Southern, Secretary. A constitution and by-laws were adopted, and several minor matters discussed. It was resolved to meet again in Chicago, Dec. 11.

New England General Passenger & Ticket Agents' Association.

At a regular meeting held in Boston, Nov. 20, it was decided, after discussion, to sell no more half-rate tickets to ministers after Jan. 1. It was also resolved to allow 100 lbs. of baggage to each full ticket, without reference to class.

ELECTIONS AND APPOINTMENTS.

Bedford, Springville, Owensboro & Bloomfield.—The announcement of the appointment of R. Black as Receiver was not correct. No receiver has been appointed.

Boston & Albany.—The following circular from the General Manager announces an appointment already briefly noted:

"Mr. E. Gallup has been appointed General Passenger Agent of this company, and will assume the duties of the office Dec. 1, with headquarters in Boston. Communications relating to competing passenger traffic, will be addressed to him. All monthly reports and divisions will be made to Mr. J. M. Griggs, General Ticket Agent, as heretofore."

Burlington & Lamoille.—At the annual meeting in Burlington, Vt., Nov. 18, the following directors were chosen: Lawrence Barnes, Waldo Brigham, H. N. Field, Wm. B. Hatch, George W. Hendee, D. C. Linsley, George Linsley, Morillo Noyes, Nathaniel Parker, Cyrus M. Spaulding, Josiah Tuttle, L. F. Terrill, H. F. Wetherby. The board elected Wm. B. Hatch President; Nathaniel Parker, Vice-President; D. C. Linsley, General Manager; Edward W. Peck, Secretary and Treasurer.

Chicago & Northwestern.—The St. Paul *Pioneer-Press* reports that Mr. H. Knapp has been appointed Assistant General Freight Agent, with special jurisdiction over the Winona & St. Peter and its branches. He has been General Agent at Winona for some time.

Cincinnati, Effingham & Quincy Construction Co.—Mr. R. Black, of Danville, Ill., has been appointed Receiver at the suit of E. Pratt Buell.

Cincinnati Pool Commissioner.—Cincinnati dispatches state that Mr. A. E. Schraeder, late of Evansville, Ind., has been appointed Commissioner of the East-Bound Freight Pool from that city. Mr. Schraeder was at one time General Freight Agent of the St. Louis & Southeastern, and before held the same position on the Evansville & Crawfordsville.

Connecticut Central.—At the annual meeting in Hartford last week, the old board was reelected as follows: George Beach, Hartford, Conn.; J. A. Thompson, Melrose, Conn.; E. S. Henry, Rockville, Conn.; A. P. Prickett, Hazzardville, Conn.; H. P. Stedman, East Hartford, Conn.; F. Gowdy, N. S. Osborn, J. N. Stiles, Lemuel Stoughton, East Windsor, Conn.; William Birnie, Willim Phelps, D. D. Warren, Springfield, Mass. The board reelected D. D. Warren President.

Empire Line.—Mr. J. McC. Creighton has been appointed General Manager. He has been for some time Superintendent of the Western Pennsylvania Division, Pennsylvania Railroad, and was formerly Agent at Pittsburgh.

Greenville & Columbia.—The South Carolina Circuit Court has appointed Mr. Connor, late Attorney-General of the State, Receiver of this road.

Illinois Central.—Mr. C. J. E. Tucker has been appointed General Western Passenger Agent, with Frank Van Dusen as assistant.

Joplin.—At the annual meeting in Girard, Kan., Nov. 18, the following directors were chosen: A. Baxter, E. H. Brown, C. G. Hawley, Frank Playter, Cherokee County, Kan.; L. P. Cunningham, E. R. Moffett, John B. Sergeant, Joplin, Mo.; Wallace Pratt, C. H. Prescott, Kansas City, Mo. The board reelected all the old officers, as follows: President, E. R. Moffett; Vice-President, Frank Playter; Superintendent, E. H. Brown; Treasurer, John B. Sergeant; Secretary, J. A. Hardin.

Kansas City, St. Joseph & Council Bluffs.—On and after Nov. 15 the office of the Assistant Treasurer will be discontinued. Mr. J. S. Ford is appointed Auditor of all the accounts of the Operating Department, with office at Kansas City, and all orders issued by him relative thereto will be respected. Mr. J. H. Aldrich is appointed Cashier, with office at Kansas City. He will have charge of receipts and disbursements, and after this date all drafts for balances, due from this to other roads for car mileage, ticket or other accounts may be drawn on him.

Kansas Pacific.—The office of the Receiver has been removed from St. Louis to Kansas City, Mo. The office of A. H. Calef, Cashier, will remain in St. Louis.

Leavenworth, Lawrence & Galveston.—The following appointments are made, to take effect Nov. 15:

Mr. J. S. Ford is appointed Auditor, with office at Kansas City. He will have charge of all the accounts of the Operating Department, and all orders issued by him relative thereto will be respected. Mr. C. J. Smith is appointed Assistant Auditor.

Mr. J. H. Aldrich is appointed Cashier, with office at Kansas City. He will have charge of receipts and disbursements, and on and after Nov. 15 all drafts for balances due from this to other roads for car mileage, ticket or other accounts, may be drawn on him. Balances due this company by other roads should also be remitted to him.

Louisville, Cincinnati & Lexington.—The following circular is dated Nov. 19: "Mr. A. Schaeffer having been appointed Master Mechanic for this company, vice Mr. S. S. Pilson, resigned, will this day assume charge of the motive power, rolling stock, machinery, shops and round-houses.

foremen, operatives and employés of the Mechanical Department will report to him. The office of General Foreman is abolished, and Mr. James Meehan, who has temporarily occupied that position, will resume his former charge of the yards and round-houses at Newport and Taylors."

Mississippi & Tennessee.—At the annual meeting in Memphis, Tenn., Nov. 20, the old board was reelected as follows: H. S. McComb, E. C. Walthall, N. Howard, A. M. West, F. M. White, A. T. Lacey, N. R. Sledge, R. P. Neely, John Robertson. The board reelected H. S. McComb, President.

Missouri River, Fort Scott & Gulf.—The following appointments are made, to take effect Nov. 15:

Mr. J. S. Ford is appointed Auditor, with office at Kansas City. He will have charge of all the accounts of the Operating Department, and all orders issued by him relative thereto will be respected. Mr. C. J. Smith is appointed Assistant Auditor.

Mr. J. H. Aldrich is appointed Cashier, with office at Kansas City. He will have charge of receipts and disbursements, and on and after Nov. 15 all drafts for balances due from this to other roads for car mileage, ticket or other accounts, may be drawn on him. Balances due this company by other roads should also be remitted to him.

Monadnock.—At the annual meeting in Peterboro, N. H., Nov. 19, the following directors were chosen: O. H. Bradley, J. H. Fairbanks, H. K. French, Wm. G. Livingston, Willis Phelps, James A. Rumrill, Peter Upton. The board elected H. K. French, President; Wm. G. Livingston, Clerk and Treasurer. The road is leased to the Boston, Barre & Gardner.

Nashua & Lowell.—At a recent meeting the board elected Cornelius V. Dearborn, of Nashua, N. H., a director, in place of Horace P. Watts, resigned. Mr. Dearborn is Treasurer of the company. The board then elected Mr. Francis A. Brooks, of Boston, President, in place of Wm. A. Tower, resigned.

Naugatuck.—At the annual meeting in Bridgeport, Nov. 19, the old board was reelected, as follows: W. D. Bishop, E. F. Bishop, R. Tomlinson, Bridgeport, Conn.; R. M. Bassett, Derby, Conn.; F. J. Kingsbury, Waterbury, Conn.; J. G. Wetmore, Winstead, Conn.; H. Bronson, J. B. Robertson, New Haven, Conn.; A. L. Dennis, Newark, N. J. The board reelected the old officers, as follows: President, E. F. Bishop; Secretary and Treasurer, Horace Nichols; Superintendent, George W. Beach; Auditor, Samuel Wilmot.

New Haven & Derby.—At the annual meeting in New Haven, Conn., Nov. 19, the following directors were chosen: J. H. Bartholomew, George P. Cornell, Thomas L. Cornell, Charles L. English, H. S. Dawson, Charles Atwater, Thomas Wallace, G. W. Shelton, Isaac Anderson, N. D. Sperry, Joel A. Sperry, M. Frank Tyler.

New York, Providence & Boston.—Mr. J. B. Gardner, Assistant Superintendent, has been appointed Acting Superintendent, in place of A. S. Matthews, now Chief Engineer.

Old Colony.—At the annual meeting in Boston, Nov. 26, the old board was reelected, as follows: Uriel Crocker, Francis B. Hayes, Boston; Charles F. Choate, Cambridge, Mass.; Frederick L. Ames, Easton, Mass.; Samuel L. Crocker, Taunton, Mass.; Thomas J. Borden, John S. Brayton, Fall River, Mass.; George Marston, New Bedford, Mass.; Jacob H. Loud, Plymouth, Mass.; Royal W. Turner, Randolph, Mass.; Ephraim N. Winslow, Hyannis, Mass.; Elisha W. Williams, Newport, R. I.; Onslow Stearns, Concord, N. H.

Princeton & Anoka.—This company was organized at Princeton, Minn., Nov. 20, by the election of the following directors: J. T. D. Sadley, H. B. Cowles, E. C. Gile, I. S. Mudgett, C. H. Chadbourne, James McCann, H. L. Ticknor, W. Hammons, O. S. Guderian, C. T. Woodbury. The board elected J. T. D. Sadley President.

Railway Mail Service.—Mr. Wm. B. Thompson has been appointed Superintendent of Railway Mail Service, in place of Theodore N. Vail, resigned. Mr. Thompson has been Superintendent of the Ninth Division, at Cleveland, O. Mr. Lovell, late head clerk at New York, succeeds Mr. Thompson as Division Superintendent.

Rome, Watertown & Ogdensburg.—Mr. W. H. Harris, Master Mechanic, will hereafter have charge of the Car Department also, in place of H. H. Sessions, resigned.

Stansfield, Shefford & Chambly.—At the annual meeting in Waterloo, P. Q., Nov. 14, the following directors were chosen: J. P. Clark, J. G. Conie, L. L. Drummond, J. R. Langdon, Ralph Morey, E. Curtis Smith, J. Gregory Smith, G. G. Stevens. The road is leased to the Central Vermont.

Union City & Portland.—The officers of this new Indiana company are: President, C. S. Arthur; Vice-President, J. W. Headington; Secretary and Treasurer, G. W. Miller; Chief Engineer, Phineas Pomeroy.

Wilmington & Weldon.—At the annual meeting in Wilmington, N. C., Nov. 19, the stockholders reelected R. R. Bridgers, of Wilmington, President, and chose the following directors: A. J. De Rosset, George Harris, Donald McRae, Wilmington, N. C.; E. B. Borden, Goldsboro, N. C.; George Howard, Tarboro, N. C.; W. H. Willard, Raleigh, N. C.; T. C. Jenkins, B. F. Newcomer, S. M. Shoemaker, W. T. Walker, Baltimore. The new directors are Messrs. McRae, Borden and Jenkins, who succeed W. A. Wright, deceased, Hon. Curtis H. Brogden and Hon. J. Donald Cameron.

Yankton & Milwaukee.—This company has been organized at Yankton, Dak., by the election of the following directors: Gov. Howard, Ex-Gov. Pennington, Dr. Burleigh, Newton Edmunds, George H. Hund, J. H. Beadle, H. D. Wynn, Jacob Max, E. P. Wilcox.

PERSONAL.

—Mr. H. H. Blodgett, Resident Engineer of the Michigan Southern Division of the Lake Shore & Michigan Southern road, died at his residence in Laporte, Ind., Nov. 18, of consumption. He had been suffering from the disease nearly two years.

—Mr. John W. McElhinney, a large contractor, died at his residence in Rochester, N. Y., Nov. 19. His work had been chiefly for the New York Central & Hudson River road, for which he built the depots in Syracuse and other places, and a large amount of work on the third and fourth tracks.

—Charles W. Angell, the embezzling Secretary of the Pullman Palace Car Company, turns up at Lisbon, Portugal, and is said to have \$80,000 of the company's funds with him. There is no extradition treaty between Portugal and the United States, which fact, doubtless, decided Angell in his choice of that country as a residence. He seems to have reckoned without his host, however, for it is stated that the Portuguese Government has decided to give him up as an act of friendship to the United States, and that he has already been placed in charge of the United States Consul at Lisbon.

—Mr. Conrad Poppenhusen, who is chief owner of the Long

Island Railroad, and has been financially wrecked thereby, has been wrecked in another way also. He was on board the steamer Pomerania, which was sunk this week by a collision in the English Channel. Mr. Poppenhusen, however, escaped better from the physical than from the financial wreck, for he is reported among those saved.

—Mr. R. Reniff, late Superintendent of the Car Department of the Chicago & Alton road, was visited by a number of his former associates at his house in Bloomington, Ill., Nov. 23, and presented with a purse containing \$200 in gold.

—Mr. F. Broughton, General Manager of the Great Western Railway, has recently been attacked, and the management of the road abused in the *New Dominion*, published at Toronto, Ont. He accordingly applied to the Court of Queen's Bench at Toronto, and the Court last week granted leave to file a bill for criminal information for libel against the publishers.

TRAFFIC AND EARNINGS.

Railroad Earnings.

The following are reports from various states for the year ending Sept. 30, 1878:

	Earnings.	Expenses.	Net. earn.	Earn per. mile.	of exps.
Brooklyn, Bath & Coney Island...	\$52,524	\$36,827	\$15,697	\$7,503	70.15
Cayuga & Susquehanna...	51,285	67,470	*16,185	1,495	131.52
Connecticut Central...	84,031	69,841	14,190	2,401	83.14
Naugatuck...	477,834	249,435	228,399	8,383	32.18
New Haven & Derby...	102,113	60,473	41,640	7,855	59.28
Richmond, Fredericksburg & Potowmac...	314,272	160,174	154,098	3,786	51.01
Syracuse, Binghamton & New York...	593,042	413,943	179,090	7,322	59.80

* Deficit.

Other earnings are reported as follows:

Ten months ending Oct. 31:

	1878.	1877.	Inc. or Dec.	P. c.
Philadelphia & Erie.	\$2,378,585	\$2,561,801	D. \$183,216	7.2
Net earnings...	794,353	845,168	D. 50,815	6.0

Month of August:

Col. Chi. & Indiana Central.	\$331,092	.....	.....	.....
Net earnings...	68,891	.....	.....	.....

Month of October:

Houston & Texas Central.	\$426,832	\$361,649	I.	\$65,183	18.0
Net earnings...	280,040	211,984	I.	68,056	32.1
Philadelphia & Erie.	352,655	363,151	D.	40,456	10.3
St. L. & S. E. St. Louis Div.	71,002	68,234	I.	2,768	.41
St. L. & S. E. Ky. Div.	34,933	31,500	I.	3,433	10.9
St. L. & S. E. Tenn. Div.	15,783	14,680	I.	1,103	7.5

Second week in November:

Chi. & Eastern Ill.	\$17,845	\$17,250	I.	505	3.4
Denver & Rio Gr'de.	27,052	10,232	I.	7,820	40.7
St. Louis, Iron Mt. & So.	149,700	120,573	I.	29,127	24.2
Week ending Nov. 15:					
Gt. Western, of Can.	\$81,333	\$100,835	D.	\$19,502	19.3

Week ending Nov. 16:

Grand Trunk.	\$201,135	\$211,106	D.	\$9,971	4.7
Grain Movement.

Receipts of grain at the eight leading Northwestern markets for the week ending Nov. 16 have been, in bushels, for the past six years:

1878.	1877.	1876.	1875.	1874.	1873.
4,089,154	3,676,648	2,916,023	3,213,054	2,584,330	2,115,651

The receipts are very nearly the same this year as for the previous week, and as large as the average for the past four weeks, and never equaled in November in any previous year.

The shipments of these same eight markets for the same week have been:

1878.	1877.	1876.	1875.	1874.	1873.
4,268,610	4,147,443	3,739,754	3,419,362	2,537,220	2,086,429

The shipments this year are the largest for four weeks.

Of the above shipments the number of bushels and the percentages of the total shipped by rail each year were:

1878.	1877.	1876.	1875.	1874.	1873.
732,892	428,584	1,372,271	1,143,631	297,809	638,685

This year the rail shipments are smaller somewhat than the previous week, and there is but one other week this year that they have been so small; but they are larger than in any of the last six weeks that navigation was open last year.

For the same week ending Nov. 16, receipts at the seven Atlantic ports have been:

1878.	1877.	1876.	1875.	1874.	1873.
4,851,146	4,077,968	3,663,490	4,057,502	2,736,146	2,694,309

The receipts of this week this year are larger than for the previous week, but with that exception they are the smallest since the middle of July. However, before last year there has been no week in November with so large receipts.

Of these receipts at Atlantic ports, 56.0 per cent. was at New York, 15.4 at Baltimore, 12.7 at Philadelphia, 7.9 at Boston, 5.1 at New Orleans, 2.7 at Montreal and 0.2 per cent. at Portland. The New Orleans receipts are the largest since May, but not quite so large as for the corresponding week last year. It was about this time last year that the New Orleans receipts began to be so much larger than usual as to attract attention. They averaged about 220,000 bushels a week in November, and 277,000 in December, 306,000 in January, 432,000 in February, 275,000 in March, 258,000 in April, 290,000 in May, 216,000 in June, 76,000 in July, 89,000 in August, 71,000 in September and 107,000 bushels in October last.

For the week ending Nov. 25 this year receipts and shipments at Chicago and Milwaukee were:

Receipts.	Shipments.
Chicago.....	2,050,850
Milwaukee.....	803,800

Compared with the previous week there is an increase in receipts and a decrease in shipments. Compared with the corresponding week of last year there is a considerable increase.

For the same week receipts and shipments at Buffalo were:

Receipts.	Shipments.
1,762,537	1,386,309
Total.....	2,252,537

The receipts are a little more than for the preceding week, the shipments 42 per cent. less. Rail shipments increased, but canal shipments fell off 71 per cent. The shipments will be wholly by rail hereafter, probably.

For the same week ending Nov. 25 receipts at four Atlantic ports were:

New York..... 4,306,034 Philadelphia..... 639,900

Baltimore..... 734,029 Boston..... 209,250

Compared with the previous week there is an enormous increase in the New York receipts, which have only twice before been so large this year, and but twice in any previous year. Last year the heaviest receipts also were in the two last weeks of November, just before navigation closed. At the other three ports there was some decrease from the receipts of the previous week. Of the New York receipts 1,194,272 bushels, or 27.3 per cent. were by rail. Though shipments by canal from Buffalo have ceased, there will be arrivals at New York by canal boats for some time to come

Cotton Movement.

Receipts in bales at the seaboard for the week ending Nov. 22, and for the crop-year beginning Sept. 1, are reported as follows by the *Commercial and Financial Chronicle*:

	1878.	1877.	1876.	1875.	1874.
Week.....	181,376	200,980	211,823	183,104	165,853
Since Sept. 1.....	1,545,000	1,327,301	1,638,786	1,433,105	1,280,506

The exports for the same periods have been:

	1878.	1877.	Increase.	P. c.
Week.....	108,581	100,861	7,720	7.7
Since Sept. 1.....	732,368	514,522	217,846	42.3

New Orleans leads in receipts this week again, receiving 27 per cent. of the whole. Galveston received 13.5 per cent., Savannah 12.3, Charleston 10.9, Mobile 10.2 and Norfolk 9 per cent.

Coal Movement.

Coal tonnages reported for the week ending Nov. 16 are:

	1878.	1877.	Inc. or Dec.	P. c.
Anthracite.....	515,372	490,312	I. 16,060	3.2
Semi-bituminous.....	78,821	72,749	I. 6,072	8.4

There are no new developments as to the extension of the Anthracite Combination after the close of the year. It is still reported that the Lehigh Valley demands a larger allotment, and also that the Erie asks for admission.

A meeting of the Lehigh Valley coal operators was held in Bethlehem, Nov. 20, when it was finally resolved to reject the proposition for the extension of the Anthracite Combination until April 1. The Conference Committee was, however, reappointed, with authority to arrange for temporary suspensions of mining after Jan. 1, pending further negotiations.

Cumberland shipments are gaining steadily and Clearfield falling off, thus reversing last year's situation.

Pacific Through Freights.

Shipments of through freight eastward over the Central Pacific in October were: San Francisco, 4,460 tons; interior points, 2,589 tons; total, 7,058 tons, making about 706 car-loads, or an average of 26 car-loads each week-day in the month. Leading items from San Francisco were: Wool, 2,043 tons; salmon, 602 tons; tea, 417 tons; wine, 313 tons; hops, 204 tons.

Cumberland shipments are gaining steadily and Clearfield falling off, thus reversing last year's situation.

At a meeting of representatives of the lines interested, held in Cincinnati Nov. 22, it was agreed to divide all freights originating in Cincinnati and bound for points east of Port Huron, Buffalo, Pittsburgh, Wheeling and Parkersburg in the following proportions: Pittsburgh, Cincinnati & St. Louis, 24 per cent.; Cleveland, Columbus, Cincinnati & Indianapolis, 24 per cent.; Marietta & Cincinnati, 22 per cent.; Atlantic & Great Western, 18 per cent.; Cincinnati, Hamilton & Dayton, 12 per cent. The arrangement goes into effect Dec. 1.

Rapid Bridge Construction.

In a letter to *Engineering*, published in the number for Nov. 8, Messrs. Clarke, Reeves & Co., say: "In your number for Aug. 30, 1878, we observe that you have illustrated very fully the iron bridges built by us on the line of railway between Quebec and Ottawa, in Canada, last year. The time occupied in constructing and erecting these bridges (alluded to in a subsequent article of the same series) deserves attention, as it will, we think, be admitted that but for the peculiar forms and connections of American truss bridge-work, the great amount of bridging therein referred to could not have been executed in the time it was. All the plans did not receive the sanction of the engineers, and the work of construction did not fairly commence until May 15, 1877. By Nov. 10, 1877, the trains were crossing the last bridge finished, that over the St. Maurice, so that thirty-nine large spans were constructed, delivered by rail and canal boats, and in some cases hauled by team, in all between 400 and 500 miles, and erected ready for traffic in less than six months. These bridges extended over a line of railway of nearly 300 miles in length, and most of them were distant from towns or villages.

The riots referred to in your article of Sept. 20 delayed us not two months, as the writer says, but at least one month. This year we are making the remaining spans for the same railway, one of 219 ft., four of 133 ft., two of 125 ft., one of 103 ft., and one of 83 ft.—nine in all, total length 1,258 ft. Order was placed in works Sept. 26, and all will be done and shipped by Oct. 26.

Railway managers in the United States and Canada are so accustomed to have bridges and other structures built quickly, that the American system of pin connections is the only one possible for spans of above 80 ft. When it is considered that in cases of impending floods a 150-ft. span can be erected in one day, you can see why this system is a favorite one. Bridges of this sort have now been in use in the United States ten years, subject to heavy traffic, and show not the slightest sign of 'getting loose in the joints'—an effect predicted by those engineers who are opposed to the system."

Punctuality of Trains on the Great Western.

In his speech at the half-yearly meeting in London, the President, Right Hon. Hugh C. E. Childers, M. P., said that during the half-year ending with January last out of 15,020 freight trains run only 32 were delayed by failure of locomotives, or little more than one in fifty, and the average delay to all the trains was less than 19 seconds. During the same time 11,183 passenger trains were run, of which 26 were delayed by defects in engines, making an average delay to passenger trains of 6½ seconds.

Yellow Cedar for Ties.

A Wisconsin correspondent writes the *Northwestern Lumberman* that his experience with the common yellow cedar of that region proves it to be fully as durable for railroad ties as white oak and good for ten years' hard service. It holds spikes sufficiently well for all ordinary use—short curves only excepted. Along the shores of Green Bay cedar trees can be obtained for about one-half the cost of oak.

Fast Time.

Mr. Seneca Green, the popular conductor of the Chicago, Milwaukee & St. Paul Railway, made some excellent time with his train from the east Monday night. He made the remarkable run from Sparta to the North Side Depot in La Crosse, including six stops and unloading a large quantity of mail at Winona Junction, in 38 minutes—distance, 28 miles. The run from Greenfield to La Crosse, 50 miles, including a stop of twelve minutes at Sparta, was made in one hour and twelve minutes. This achievement gives the broom to Mr. Green, as this beats Conductor Clason's record made some time ago, of which mention was made in this paper. The boys are not in the habit of running recklessly, but they say that if there is such a thing as "getting in on time" they will do it, hot box or no hot box. Mr. Clason is called upon to give up his broom.—*La Crosse (Wis.) Republican*, Nov. 22.

Tough Cases.

On Friday morning a convict belonging to the night force at the Lick Log Tunnel on the Western North Carolina Railroad was thawing a charge of nitro-glycerine, mixed with meal in a can over a fire. When 41° Fahrenheit was reached, the darkey suddenly sailed fifty feet through the black air, landing at the mouth of the tunnel entirely nude—his body pitted with minute blisters. He walked coolly back to the fire and recovered his stirring paddle and a squirrel-tail which had served as an ornament to his head-gear. In this Georgia major's uniform he was put to bed; but no apprehensions are entertained that serious injury will result from his brief aeronautic tour. It is only two weeks since another convict fell 63 feet from a trestle near the mud-cut, but, contrary to all expectations, is still living. Verily the African is a hard bird to kill.—*Asheville (N. C.) Blade*.

OLD AND NEW ROADS.

Alabama Central.—The extension of this road from York, Ala., to Lauderdale, Miss., is now completed and trains began to run over it Nov. 25. The extension is 15 miles long, and the company has leased for a term of years the right to use the Mobile & Ohio track from Lauderdale to Meridian, 18 miles. Heretofore the trains have been run over the track of the Alabama Great Southern road between York and Meridian. The road is now 96 miles long, from Selma to Lauderdale.

Altoona Coal & Iron Co.—This company's road is now all completed from Martin's Station, on the Atlantic, Mississippi & Ohio, in Pulaski County, Va., to the Altoona coal mines. The contractors, McMahon & Green, graded the line, 8½ miles long, through a rough, mountainous country, in 47 working days, or 30 days less than the contract time. The train was to be running this week, and the delivery of coal will begin at once. The company has been at work at the mines for some time, and the coal is said to be of very good quality.

Ashtabula & Pittsburgh.—The following circular from the Pennsylvania Company is dated Nov. 21: "The Ashtabula, Youngstown & Pittsburgh Railroad Company having been lately reorganized pursuant to law, and being now known as the Ashtabula & Pittsburgh Railway Company, and the Pennsylvania Company having this day become the lessee of the railway, properties and franchises of said reorganized company, such lease taking effect as of Aug. 1, 1878, said railway and appurtenances will be operated, from and after the last-mentioned date, in the name of the Pennsylvania Company operating the Ashtabula & Pittsburgh Railway." All balances of accounts owing to or by the Pennsylvania Company operating the Ashtabula, Youngstown & Pittsburgh Railroad, as of Aug. 1, 1878, will be transferred to the Ashtabula & Pittsburgh Railway, Pennsylvania Company lessee, and will be accounted for to or by said lessee."

This simply continues the lease of the road by the new

company, the terms of the contract being, we believe, somewhat modified from those of the lease made by the old corporation. The new lease, it is stated, provides ample for the interest on the \$1,500,000 new 6 per cent. bonds issued by the reorganized company. The company is to spend \$10,000 in improving its docks at Ashtabula Harbor.

Bedford, Springville, Owensboro & Bloomfield.—The notice of the appointment of a receiver for this road last week was not correct. The receiver appointed was for the company which is trying to extend the road from Switz City, Ind., westward, and which has no connection with this company.

Bloomington & Fairfax.—This company has been organized to build a railroad from Bloomington in Garrett County, Md., on the Baltimore & Ohio, near Piedmont, southwest up the North Branch of the Potomac to the Fairfax Stone, which marks the dividing line between Maryland and West Virginia. It will be about 30 miles long, through a heavily-timbered country known to be rich in coal, but still rough and undeveloped. The incorporators are Lloyd Lowndes, A. P. Gorman, Patrick Hamill, M. Bannon, W. T. Jameson and John Humbird.

Boston & Providence.—This road may be taken as an example of a good property owned chiefly by small holders. At the recent annual meeting a statement was presented showing that the 40,000 shares were owned by 1,657 persons. Of these one only holds 500 shares; one 352 shares; four hold between 250 and 300 shares; five between 200 and 250 each; 14 between 150 and 100 each; 105 hold between 50 and 100 shares each; 242 between 25 and 50 each; 235 between 15 and 25 each; 203 between 10 and 15 each; 376 between five and 10 each, while 436 persons hold five shares or less. A clear majority (21,529 shares) is owned by 1,492 persons, no one of whom owns more than 50 shares.

Boston, Hoosac Tunnel & Western.—The fight between this company and the Troy & Boston in the Vermont Legislature has apparently resulted in favor of this road. The Railroad Committee has resolved to report a bill granting the Boston, Hoosac Tunnel & Western a special charter authorizing the construction of its road parallel to the track leased by the Troy & Boston, provided the new road is not to be laid nearer than 21½ feet to the Troy & Boston track, except at the State line, where connection is made with the Troy & Greenfield.

This bill has passed both houses of the Vermont Legislature. Its passage fully legalizes the construction of the road through Vermont, and will put an end to the suit brought by the Troy & Boston Company to enjoin it from proceeding, on the ground that the company had no proper legal existence in Vermont.

Brunswick & Albany.—The sale of this road to English parties has been several times reported, but local papers now state positively that the contract has been completed and that the purchasers will take possession next month. The road is completed from Brunswick, Ga., to Albany, 171 miles, and the purchasers expect to extend it from Albany to Eufaula, Ala., about 65 miles. It is a very poor property, its business being very small.

Burlington & Lamoille.—At the annual meeting in Burlington, Vt., recently, it was stated that the road is earning a fair surplus over the expenses. The stockholders voted to retire \$200,000 of the authorized amount of first-mortgage bonds and \$650,000 of the second-mortgage bonds authorized.

Central Pacific.—A report comes by way of Chicago that an arrangement has been concluded by which the main line of this road is to pass under the management of the Union Pacific. President Dillon and General Manager Clark to control the whole line from Omaha to San Francisco. The Central Pacific officers will, it is said, devote themselves to the management of their California local lines and to the extension of the Southern Pacific. The report does not appear to come from any trustworthy source, and is not a very probable one. San Francisco dispatches state that the Central Pacific officers there know nothing of the matter.

Chatfield.—This road is now completed and was to be opened for traffic this week. It extends from Elyota, Minn., on the Winona & St. Peter road, southward to Chatfield, 12 miles, and has been built in the last three months. It is a Chicago & Northwestern "proprietary" road, and will be worked as a branch of the Winona & St. Peter.

Chicago & Lake Huron.—The Detroit *Post and Tribune* of Nov. 23 says: "J. D. Norton and three others, Albany bondholders of the Chicago & Lake Huron Railroad, yesterday filed a bill in the United States Circuit Court against the Chicago & Northeastern Company in which they set forth about the same state of facts with reference to the building of the latter road as has been given in previous bills. They claim that the road was built by W. L. Bancroft, Receiver of the Chicago & Lake Huron, and largely with its earnings. They, therefore, claim a lien upon it, and ask the court to appoint a receiver. This is substantially the same as the Burruss case in which the Court refused to appoint a receiver, and the real result will be a rehearing. A formal motion for a rehearing was also filed yesterday in the Burruss case."

Chicago, Burlington & Quincy.—Track has been laid on a new branch from Creston, Ia., northwest to Fontanelle in Adair County, a distance of 22 miles. Regular trains began to run over it last week.

Work is in progress on another branch from Chariton, Ia., north by west to Indianola, about 30 miles. The company has also, it is said, agreed to extend its Leon Branch from Leon, Ia., west about 27 miles to Mt. Ayr in Ringgold County, the people along the line furnishing some aid toward its construction.

Chicago, Clinton, Dubuque & Minnesota.—A report comes from Boston that, after much negotiation, a lease of this road to the Chicago, Burlington & Quincy has been agreed upon, the lessee to pay 6 per cent. on the stock of the company, which has no bonded debt. The road, which is made up of the old Chicago, Clinton & Dubuque and the Chicago, Dubuque & Minnesota, extends from Clinton, Ia., to La Crescent, Minn., 176 miles, with a branch from Turkey River, Ia., to Wadena, 44 miles. Reports of the lease have been circulated several times recently.

Cincinnati, Effingham & Quincy Construction Co.—A receiver has been appointed for this company, which was organized to build several narrow-gauge roads, which, if completed, would form a line from Cincinnati to Quincy, Ill.

Cleveland, Columbus, Cincinnati & Indianapolis.—A singular accident occurred in the shops of this road at Cleveland Dec. 23. The car-repair shop is a brick building about 250 feet long, and had suspended from the roof two floors or stages, upon which lumber was stored to dry. The weight proved too much for the roof, and it fell in, crushing everything beneath it. Fortunately sufficient warning was given to enable the men working in the shop to escape, though four of them were hurt by the falling timbers.

Dallas & Wichita.—It is said that arrangements have been made for the sale of this unfinished road to some Boston parties who will finish 100 miles of it at once. The road, which is now in the hands of a receiver, is completed from Dallas, Tex., northwest 17 miles, and graded some 20 miles further.

Dannemora.—This road is now very nearly completed, and is to be ready for traffic by Dec. 1. It is of 3 ft. gauge and 17 miles long, extending from the New York & Canada at Plattsburg, N. Y., westward to the Clinton State Prison. It is built through a rough, hilly country, and rises in all 1,900 feet, an average grade of 70 feet to the mile. It has been built chiefly by convict labor, and is, we believe, owned by the State, the object of its construction being chiefly to secure a rail connection for the prison, which was considered necessary.

Delaware Shore.—This road, from Woodbury, N. J., to Penns Grove, was so badly damaged by storm some three weeks ago that all trains were stopped. A number of the people along the line then offered their labor to repair it, and trains began to run again this week.

Denver & Rio Grande.—From a recent statement of this company it appears that the bonded debt has been fixed at \$6,382,500, of which \$5,578,000 have been sold, and \$804,500 are reserved to fund the ten-year coupon certificates. There are also \$1,040,000 bonds of the Arkansas Valley Division (Pueblo to Canon City), which are issued under an independent mortgage and are held in trust to secure the bonds of the Central Colorado Improvement Company.

President Wm. J. Palmer has issued a circular in reference to the proposed equalization of the stock and debt per mile with that of the Pueblo & Arkansas Valley Railroad Company. The recent negotiations with the Atchison, Topeka & Santa Fe Company had for their object the consolidation of the company which has built and is building the various extensions of that line, called the Pueblo & Arkansas Valley Railroad Company, with the Denver & Rio Grande Company, but this was found to be prevented by legal obstacles. As to the further agreements made, the following is condensed from the circular:

As the closest practicable union, short of consolidation, the plan of lease to the Atchison Company was adopted, coupled with a separate personal agreement made with Wm. J. Palmer for the interchange of stocks of the Denver & Rio Grande and the Pueblo & Arkansas Valley Companies, on the general principle of equalizing the sum of the stock and debt per mile of the latter company with the sum of the stock and debt per mile of the former. The stock of the Pueblo & Arkansas Valley Company is \$15,488 per mile, and that of the Denver & Rio Grande Company \$25,222 per mile.

The stock of the former company has a debt of only \$11,780 per mile ahead of it; the debt of the latter is accepted under the agreement at \$22,664 per mile; but this does not include further debt caused by work done and expenses incurred on account of the Leadville, Maxwell and Santa Fe extensions (expected to be paid from subscriptions, which, by reason of this negotiation, cannot now be utilized), as well as other liabilities and the expenses of closing up. The exact amount of this further debt cannot be accurately determined until the accounts have all come in, but the total will not exceed \$500,000. The interests of the bondholders are well protected by the lease, in which it is provided that the entire rental shall be deposited monthly in trust, to be apportioned as follows:

First.—To payment of interest on the debt of the Denver & Rio Grande Railway Company to the amount of \$22,664 per mile.

Second.—To paying off debts not included in the above \$22,664 per mile which are not in the form of mortgage bonds, and which amount to \$210,000.

Third.—If any surplus remains, it must be applied to the redemption and cancellation of the first-mortgage bonds, at the market price, up to 10 per cent. premium.

Although under the above provisions the probability of any direct returns from Denver & Rio Grande stock is, to say the least, remote, the separate agreement for the conversion of this stock into that of the Pueblo & Arkansas Valley Company secures to those who take advantage of it the full benefit of the plan for the blending of interests. The personal agreement provides that \$1,700,000 Pueblo & Arkansas Valley stock, or such portion of it as may be called for by William J. Palmer, shall be applied through him to the payment of the said debt in excess of \$22,664 per mile, and to the interchange *pro rata* with the whole \$8,500,000 of the Denver & Rio Grande stock, or so much thereof as may be presented by him for exchange. This interchange of stocks, which can only take place through William J. Palmer, is not a matter of agreement or of right between the two companies, but simply a personal undertaking whereby all stockholders who choose to join within a certain time can secure the advantages which would have been derived from a merger of stocks, as well as exemption from that risk to the Denver & Rio Grande which necessarily results from the transfer of possession and control to a rival company.

Elberton Air Line.—The track on this road is now laid to a point 40 miles east by south from the junction with the Atlanta & Charlotte Air Line at Toccoa, Ga., and 10 miles beyond the late terminus at Royston. Work has been begun on the depot at Elberton, and the company hopes to reach the terminus by the end of the year.

Flint & Pere Marquette.—This company is building a branch two miles long from Lake Station, Mich., northward, to reach a large tract of pine.

The land sales of the company up to Sept. 30 this year exceeded those for the whole year 1877.

In the three months ending Nov. 15 there were 39,205 barrels of apples shipped over this road from stations along the line. Of these 33,707 barrels were shipped westward to Ludington and thence to points in Wisconsin and Minnesota.

Golden, Boulder & Caribou.—This company owns a line of standard gauge from Boulder, Col., to the Marshall coal mines, about six miles. It is now proposed to extend it to Nederland, 14 miles beyond the present terminus, and thence 12 miles further to Central City. The line through the Boulder Canon is said to be practicable, and the extension would reach several mining camps, which would furnish a considerable freight business, besides opening new markets for coal.

Gowrie, Sac City & Western.—This company has been organized to build a railroad from Gowrie, Ia., on the Des Moines & Fort Dodge road, west to Sac City, about 45 miles, with a possible extension further to some point on the Mapl River road.

Greenville & Columbia.—After hearing argument on behalf of the various classes of creditors, the Circuit Court, at Columbia, S. C., last week, granted a motion for the appointment of a receiver, and afterward appointed ex-Attorney-General Connor Receiver. There is already pending an application for the appointment of a receiver before the United States Court, which has issued a preliminary injunction, and this action may lead to a conflict of jurisdiction.

Hanover Junction & Susquehanna.—A large part of this road was graded some time ago, but work has been suspended for two years past. Arrangements have now been made, however, to complete a section about six miles long, from Landisville, Pa., on the Reading & Columbia road, southwest to Chickies Furnace on the Susquehanna. Ties and iron have been bought for this piece of road, on which the grading and bridging is all done.

Hoosac Tunnel Line.—The Boston *Advertiser* says: "The Hoosac Tunnel Line is doing so extensive a business that the General Manager has invited the twenty western railroads that own cars in the line to increase the equipment to 5,000 cars. His apportionment would make the quota of the Lake Shore Railway 1,163, the New York Central 1,290, the Michigan Central 133, the Great Western 181, the Wabash 652, and so on to the end of the list. It is understood that nearly all the roads interested have already signified their readiness to furnish the desired quotas."

Illinois Central.—Chicago papers state that this company has positively refused to have anything to do with the proposed pool on freight business from Cairo eastward. The reasons given are that the company does not wish to subject its Cairo business to the control of others, and that its business is already sufficiently complicated by the numerous crossings and junctions on its line, at many of which it has already standing agreements as to transfer and division of business.

Advices from the officers of the company, however, indicate that it has made no such refusal, but has intimated its desire to do whatever may be necessary to maintain rates; but has shown that there has never been any trouble about Cairo business, and expressed the opinion that a Cairo pool would be superfluous.

Joplin.—Officers of this company are now examining the line of the proposed extension from Joplin, Mo., southward into Arkansas. It is intended to run the line southward until it strikes the Little Rock & Fort Smith road, provided sufficient encouragement is given by the people of the country.

Kansas City, St. Joseph & Council Bluffs.—General Manager Nettleton writes us as follows, under date of Nov. 18:

"Reports having been circulated that the general offices of the Kansas City, St. Joseph & Council Bluffs Railroad are to be removed from St. Joseph to Kansas City, I desire to say that such reports have no foundation in fact. St. Joseph will continue to be headquarters of the offices of this road."

Lake View & Virginia.—Contracts have been let for the first section of two miles from Virginia City, Nev. The road is to be of 3 ft. gauge.

Lockport & Buffalo.—The crossing over the New York Central track having been put in and connection made with the Erie at Tonawanda, N. Y., tracklaying is now progressing steadily, the grading and bridging being all ready. The rails are now laid to a point eight miles northeast from Tonawanda, leaving six miles to be completed to Lockport. It is hoped that the road will reach the latter place in December.

Los Angeles & Santa Monica.—It is proposed to build a narrow-gauge road from Los Angeles to the port of Santa Monica to secure a connection between Los Angeles and the coast lines of steamers independent of the Southern Pacific. The distance is about 15 miles, and there is already a line between the two places, which was built by the Los Angeles & Independence Company, but was afterward sold out to the Southern Pacific, which now controls all the approaches to Los Angeles.

Mansfield Branch.—It is proposed to build a branch from Mansfield, Pa., to the new Pittsburgh & Lake Erie road, at the mouth of Chartiers Creek. The distance is four miles, and for nearly half the way there is an old road-bed, formerly used for a track running from Mansfield to the Chartiers Valley coal mines.

Massachusetts Central.—This company gives notice of application to the Massachusetts Legislature for an extension of time in which to complete its road; for authority to lease or buy other roads, and to consolidate with other companies.

New Bonds.—Several issues of bonds are now offered for sale in New York, among them the following:

Scioto Valley 7 per cent. first-mortgage bonds; total issue \$1,300,000 on 100 miles of road. They are sold by Winslow, Lamier & Co. at 92½ and interest. The road was completed last year.

Siox City & Pembina 7 per cent. first-mortgage bonds, guaranteed by the Dakota Southern, are offered for sale by Walston H. Brown & Co., at 87½ and interest. The issue is stated at \$6,000 per mile. The road is now being extended.

Keokuk & Des Moines 5 per cent. first-mortgage bonds, interest guaranteed by the Chicago, Rock Island & Pacific, which leases the road, are sold by John J. Cisco & Son, at 87½ and interest. These bonds are issued to replace the existing first-mortgage bonds and fund other debt.

Delaware, Lackawanna & Western 7 per cent. consolidated bonds are offered by Daniel A. Moran. These have been on the market for some time.

Louisville & Nashville 7 per cent. second-mortgage bonds, part of an issue of \$2,000,000, are offered by John J. Cisco & Son. Price not stated.

New Orleans Pacific.—The Shreveport (La.) *Times* says of this road: "A construction company has been formed, composed of David Urquhart and associates, in New York and New Orleans, with ample capital to push the work on to completion. Major James is still the contractor for grading, under this company, and will work about 800 hands. A portion of the hands are now engaged on the line below Alexandria, and a portion are grading the road west near the line of De Soto and Natchitoches parishes. The road between Alexandria and the Mississippi River, a distance of 100 miles, is all graded, and only needs dressing up preparatory to laying the track."

"Iron has been purchased and tracklaying will begin at Alexandria and be extended east, thus opening up a magnificent country on the alluvial bayous, and giving the road a heavy and lucrative trade from the start. When the gap between Alexandria and the Mississippi River is completed, the iron will be laid from Alexandria west. It was necessary to grade nearly 200 miles, in order to give the company a basis of credit. Having made negotiations by which the road can be ironed and equipped, it is very desirable to put all the track graded in running order. The contractor is now laboring under disadvantages on account of the distance from navigation, and the cost of transporting his supplies and men by wagon."

"The track will be laid from Alexandria to Bayou Goula, and in the event of a failure to consummate negotiations now pending for purchasing the completed railroad from that place to Algiers, opposite New Orleans, the company has the right to cross the river and construct their road on the east bank to the city. Major James states that the road will be running to this city in eighteen months."

New York & Oswego Midland.—At a meeting of holders of Receiver's certificates in New York, Nov. 21, about two-thirds in amount of the certificates were represented. The committee appointed to confer with the first-mortgage bondholders presented the plan agreed upon, the points of which have been already noted. The plan was adopted, and Messrs. Wm. H. Wickham, J. Davenport, Jr., Wm. C. Whitney, W. H. Fenner, Jr., Wm. O. McDowell, C. J. Williams and J. Brisbin were appointed a committee to carry it into effect. The first work of the committee will be to prepare an agreement for signature. The bondholders will not meet until Dec. 17.

New York, Lake Erie & Western.—Fair progress has been made recently with the third rail on this road. On the Eastern Division much work has been done on the sidings and in the yards, only slow progress being possible in the latter, on account of the constant interruption from trains. On the Delaware Division most of the work is done, and standard-gauge trains will be able to run in a few days. The new standard-gauge freight cars are being delivered rapidly and a large number are already on hand.

New York State Canals.—Canal Superintendent Clark gives notice that navigation on the Erie, the Champlain, the Oswego and the Cayuga & Seneca canals will be closed on Saturday, Dec. 7, unless sooner stopped by ice. Of this there is no present prospect. The Erie Canal opened for navigation this year on April 15, so that the season has been an unusually long one, giving 237 days of navigation.

Northern Pacific.—The St. Paul (Minn.) *Pioneer-Press* of Nov. 24 says: "It was announced yesterday morning that the St. Paul & Pacific and the Northern Pacific railroads had arrived at a basis of agreement for using jointly the line of road between St. Paul and Sauk Rapids, hence rendering the construction of a parallel line from St. Cloud to Minneapolis unnecessary."

The terms of the agreement are not made public, but it is understood that, besides securing better terms for its St. Paul business, the Northern Pacific is to have the right to run its trains from Sauk Rapids west two miles to St. Cloud, and to compete for business from that place.

Ohio & Mississippi.—A bill to foreclose the second mortgage has been filed in the United States Circuit Court in Indianapolis by Henry Crawford, who claims to represent holders of a large amount of bonds.

Ohio Central.—The parties who bought this road at the foreclosure sale last March, have organized the Columbus & Sandy Creek Railroad Company, with a capital stock fixed at \$750,000. The new company is said to be controlled in the interest of the Pennsylvania Company. The road is completed from Moxahala, O., to New Lexington, 9 miles, and from Bremen to Newark Crossing, 27 miles, the two sections being connected by the use of the Cincinnati & Muskingum Valley track from Bremen to New Lexington, 12 miles.

Old Colony.—At the annual meeting in Boston, Nov. 26 a resolution was offered instructing the directors not to offer tickets to state officers or members of the Legislature except at regular rates. After some discussion it was amended so as to leave the matter to the discretion of the directors and then passed. It was resolved that a record of all persons receiving free passes should be kept, with the reasons for granting such passes, this record to be always open for the inspection of stockholders.

Passaic & Delaware.—This road, formerly the New Jersey West Line, has been put in good condition at a considerable expense, and trains were to begin running over it again this week. It will be operated by the Delaware, Lackawanna & Western Company, as a branch of the Morris & Essex Division. It is 15 miles long, from Summit, N. J., to Bernardsville, and was recently sold under foreclosure and reorganized. Trains have not run over it for several months, having been suspended on account of its bad condition.

Pennsylvania.—This company's statement for October shows, as compared with October, 1877, for all lines east of Pittsburgh and Erie:

An increase in gross earnings of..... \$5,381
A decrease in expenses of..... 48,893

Net increase..... \$54,274

For the ten months ending Oct. 31, as compared with the same period in 1877, the same lines show:

An increase in gross earnings of..... \$819,041
A decrease in expenses of..... 603,525

Net increase..... \$1,422,566

The lines west of Pittsburgh and Erie for the ten months of 1878 show a deficiency in meeting all liabilities of \$82,939, being a gain over the same period in 1877 of \$213,535.

The answer of the company in the injunction suits begun by the Attorney General has been filed. It is long, but contains much repetition and is a general denial of the alleged discriminations in the transportation of oil. The company claims that it has exercised no discrimination in this business; that it has supplied cars to oil producers, as far as possible, and has even sent its oil cars long distances over connecting lines to meet their requisitions.

Philadelphia & Reading.—This company's statement for October and the eleven months of its fiscal year from Dec. 1 to Oct. 31 is as follows:

October..... 1878. 1877. Eleven months..... 1878. 1877.

Gross earnings: Railroad traffic..... \$1,205,373 \$1,330,857 \$10,182,762 \$11,208,253

Canal traffic..... 149,442 127,106 790,408 893,030

Steam colliers..... 40,172 54,746 487,201 580,374

Rich'm'd barges..... 13,687 15,065 92,728 117,884

Total R. R. Co. \$1,408,674 \$1,597,774 \$11,553,099 \$12,805,541

Coal & Iron Co. 910,521 1,129,022 7,062,996 9,052,646

Total..... \$2,319,195 \$2,656,796 \$18,616,095 \$21,858,187

Traffic:

Passengers..... 571,250 612,263 5,905,231 6,185,254

Tons merchandise..... 208,819 305,876 2,898,807 2,904,780

Tons coal..... 600,333 802,940 5,105,332 6,589,838

Tons coal on colliers..... 41,946 59,650 526,157 542,598

Tons coal mined: By Coal & Iron Co. 209,288 441,902 2,349,017 3,422,281

By tenants..... 133,298 163,280 956,127 1,255,168

Total..... 432,566 607,122 3,305,144 4,677,440

The receipts of the railroad company for the eleven months sh. w a decrease of \$1,252,442, or 9.8 per cent.; those of the Coal & Iron Company a decrease of \$1,989,650, or 22.0 per cent., making a total decrease for both companies of \$3,242,092, or 14.8 per cent.

The company has lost the second of its steam colliers since the fleet was built, the Rattlesnake, one of the older and smaller boats being reported ashore. The losses on this fleet by shipwreck have been very small, considering the number of voyages made.

Pittsburgh & Lake Erie.—The arrangements for the business of this new line, which will soon be opened, are substantially as follows: Passenger business between Pittsburgh and Cleveland will be taken by the Atlantic & Great Western between Youngstown and Cleveland—trains being run through. Freight between Pittsburgh and points south and southwest of Cleveland will be taken at Youngstown by the Atlantic & Great Western; freight to points west and northwest of Cleveland will be carried by the Atlantic & Great Western to Cleveland and there turned over to the Lake Shore road. All east-bound freight from Pittsburgh will be turned over to the Lake Shore at Youngstown, passing over that company's Mahoning Coal Branch to its main line at Ashtabula. The new road is to have the use of the other companies' depots and yards at Youngstown, and is to be given all necessary facilities for its through and local business.

The preparations for business at Pittsburgh are being hurried forward. The freight and passenger stations on the south side are nearly finished, and the round-house is ready for the roof. The trestle work is going up rapidly, a large force being employed. A number of sidings are being put down to accommodate the mills on and near the line.

The track is now all laid except about two miles on the south side of the Ohio near Pittsburgh, which waits the completion of the trestle work. This, it was expected, would be laid this week, so that the opening of the road for traffic will probably take place in December. The whole length of the road from Pittsburgh to Youngstown is 68 miles.

Portland & Ogdensburg, Vermont Division.—Notice is given that a hearing will be had in the Chancery Court, at St. Johnsbury, Vt., Dec. 27, on a petition filed by the Receivers, asking the Court to authorize them to raise in such manner and on such security as the Court may direct, the sum of \$500,000, to be used in putting the road in good condition, in paying off debt incurred by the Receivers, and in paying for engine-houses and shops, and for docks at Swanton.

Princeton & Anoka.—This company has been organized to build a railroad from Anoka, Minn., on the St. Paul & Pacific north by west to Princeton in Mille Lacs County, about 30 miles. A survey of the line is to be made at once.

Quincy, Missouri & Pacific.—A new contract for six miles of grading, which will carry the extension to Milan, Mo., has been let to Ahern, Shanahan & Reece, who have already begun work. The grading is finished to a point six miles beyond Greencastle, and the bridges are being put up.

Railroads in New South Wales.—From the report of the Engineer-in-Chief, Mr. John Whitton, it appears that the government has sanctioned the construction of 553 miles of railroad, 283 of which are under construction. The country is favorable, and there are not many important structures on the lines. Surveys have been made for 2,137 miles, including city and suburban lines. This year, down to October, 74 miles of new road had been opened for traffic.

St. Paul & Pacific.—The United States Circuit Court has authorized Receiver Farley to issue \$1,016,300 in bonds, pursuant to an agreement with the parties who advanced the money for the completion of the St. Vincent Extension, who are the same persons who recently bought a controlling interest in the bonds. These bonds will be a lien upon 75 miles of the road between Crookston and St. Vincent and 46 miles between Melrose and Glyndon. They are not to be issued until the Governor of Minnesota has officially certified to the completion of the road.

Sioux City & Pembina.—Construction trains on this road last week ran through to Eden, Ia., and regular trains were to begin running to that point this week. Eden is five miles northward from the late terminus at Calliope, 39 miles from the junction with the Dakota Southern at Davis, and 52 miles from Sioux City. The road is leased to the Dakota Southern Company.

Spencer.—Track is now all laid on this road, and it will soon be opened for traffic. It is a short local line, built by local capital, and extends from Spencer, Mass., to Spencer Station, on the Boston & Albany, a distance of two miles. It will be worked by the Boston & Albany as a branch.

Texas & Pacific.—The following circular is issued by the General Passenger Agent:

"Commencing Dec. 1, 1878, this company will require five cents per mile, regardless of class, upon all business coming to this line at Sherman, Bellplain or Dallas, and destined to any point on this road (except Fort Worth) from the following territory, viz.: St. Louis and all points east of the Mississippi and north of the Ohio rivers.

"No emigrant tickets will be accepted via Sherman, Dallas or Bellplain for the above-named territory, except to Fort Worth.

"The divisions on first-class and emigrant business to Fort Worth, via Sherman and Dallas, will be the same as now in force until further notice."

Union City & Portland.—This company has been organized to build a narrow-gauge road from Union City, Ind., north by east to Portland in Jay County, about 18 miles. The capital stock is \$100,000.

Union Pacific.—Notice is given that, in accordance with the provisions of the mortgage, 68 Omaha Bridge bonds were, on Nov. 20, drawn by lot for redemption, and that the said bonds will be paid April 1, 1879, at the office of Drexel, Morgan & Co., in New York, or at the London & San Francisco Bank in London. The numbers of the bonds drawn were: 36, 75, 186, 216, 263, 270, 294, 318, 358, 413, 431, 440, 474, 488, 504, 510, 558, 578, 596, 624, 677, 765, 800, 881, 887, 889, 914, 915, 927, 939, 947, 1013, 1068, 1094, 1130, 1140, 1190, 1191, 1230, 1332, 1354, 1369, 1398, 1416, 1445, 1515, 1613, 1617, 1621, 1630, 1633, 1712, 1751, 1786, 1854, 1977, 1979, 2039, 2111, 2279, 2425 and 2426.

Western, of North Carolina.—The New York Court of Appeals has finally decided the suit of this company against Bayne & Co. in favor of the company, setting aside all the claims of Bayne & Co. against the road, including the \$425,000 of bonds held by them, as fraudulent and void. In this the Court followed the decisions of the North Carolina courts which have heretofore decided that the \$900,000 mortgage executed in 1870 was illegal and void and directed the surrender of the bonds within their jurisdiction. The suits have been pending for nearly eight years, but are now finally disposed of.

Work has been in progress for some time on the extension of the road from Egypt, N. C., toward Greensboro, chiefly with convict labor loaned by the state. The grading is now finished from Egypt northwest eight miles, and the long and expensive bridge over Deep River is nearly done. Some iron has been bought, and the company expects to have cars running by Jan. 1 to Gulf, in Chatham County, three miles beyond Egypt and 46 miles from Fayetteville. The company hopes to be able to push work on the extension, now that its litigation is settled.